JUN 1 5 1911

June 15, 1911.

PUBLIC LIBRARY

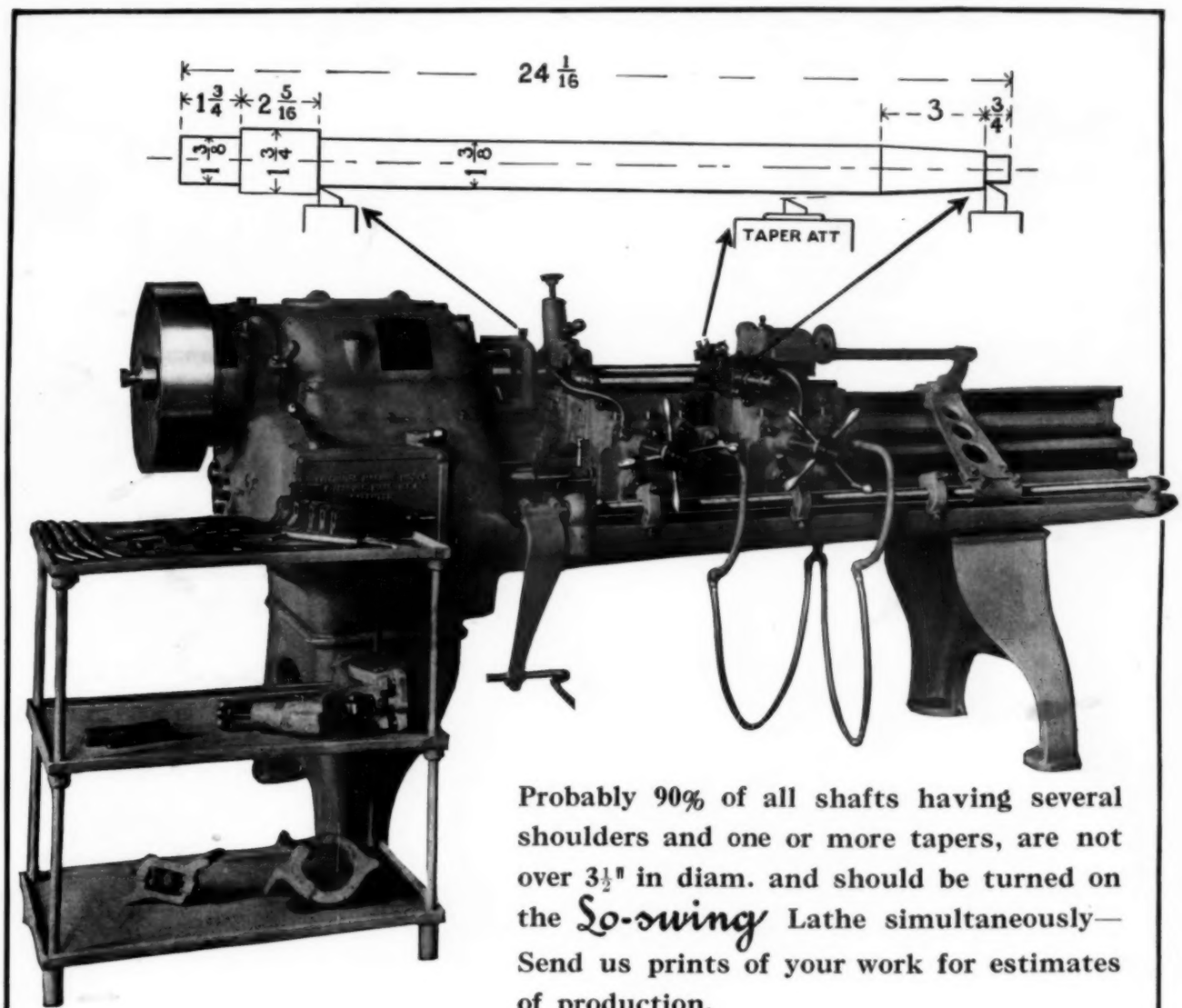
American Machinist

A Practical Journal of Machine Construction

Issued Weekly by the Hill Publishing Company : : : 505 Pearl Street, New York

Price 15 Cents, $4.00 per Year

Contents 1139. Advertising Index 51



Probably 90% of all shafts having several shoulders and one or more tapers, are not over 3½" in diam. and should be turned on the *So-swing* Lathe simultaneously—Send us prints of your work for estimates of production.

THE *So-swing* LATHE

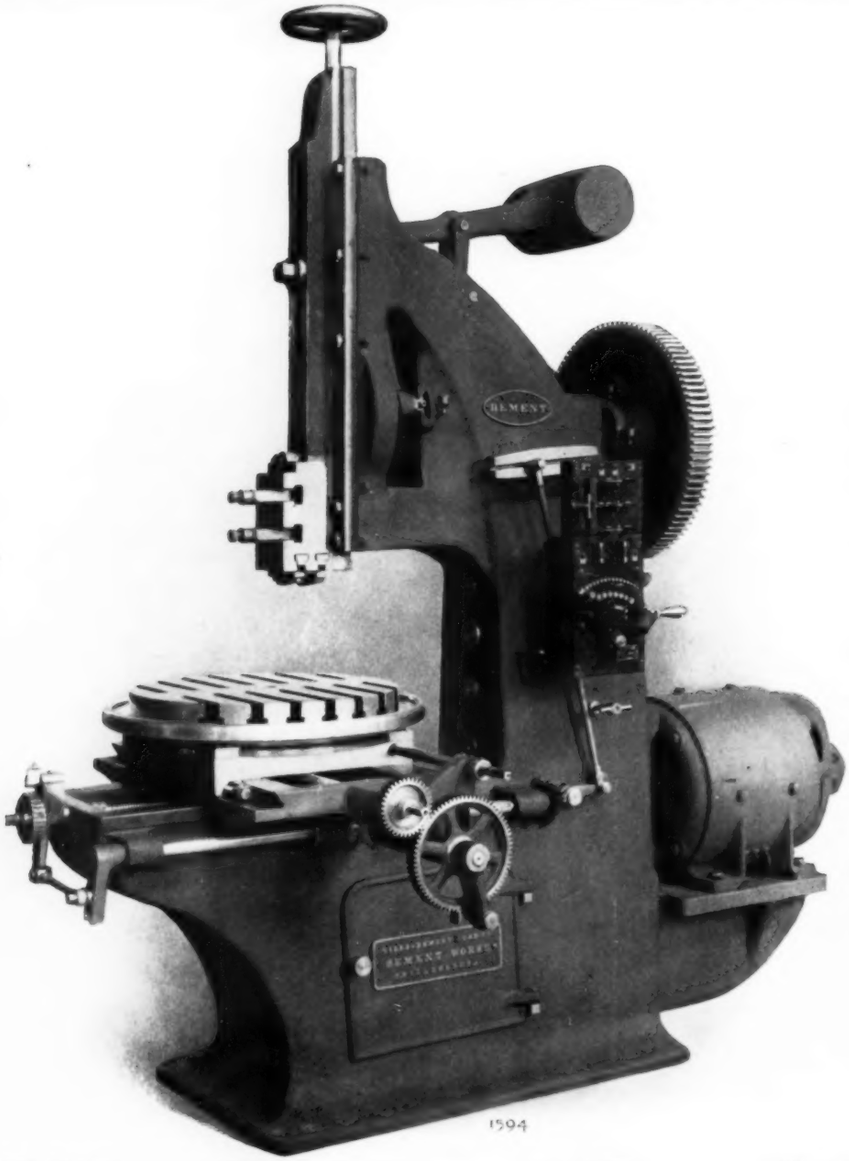
Fitchburg Machine Works, Fitchburg, Mass., U.S.A.

FOREIGN AGENTS—Alfred H. Schutte, Paris, Brussels, Cologne, Milan, Barcelona. Schuchardt & Schutte, Vienna. Buck & Hickman, London, Birmingham, Manchester, Glasgow. H. W. Petrie, Ltd., Toronto, Montreal.

For Rapid, Accurate Slotting

At Heavy Feeds in Bronze, Iron and Steel

Bement Slotting Machines—



THE BEMENT SLOTTING MACHINE is particularly applicable to a large variety of work not possible on shapers and planers. Their use shows a marked economy over "makeshift" slotting operations that are usually done at a great expense of time and labor. "Makeshift" operations are seldom satisfactory. Duplication is difficult to obtain, machines needed for regular work are "tied-up" and the routine work of the shop generally upset.

Considering initial cost of Bement Slotting Machines, it is not economy to resort to "makeshift" operations.

Built in a large range of sizes—6 to 68 inch stroke—and with all modern conveniences for rapid operation.

Belt or Motor Driven.

Write for circular covering any size.

Niles-Bement-Pond Company

111 Broadway, New York. 23-25 Victoria St., London, S. W.

SALES OFFICES—Boston: Oliver Bldg. **Philadelphia:** 21st and Callowhill Sts. **Pittsburgh:** Frick Bldg. **Cleveland:** The Niles Tool Works Co., Rockefeller Bldg. **Hamilton, O.:** The Niles Tool Works Co. **Detroit:** Majestic Bldg. **Chicago:** Commercial National Bank Bldg. **St. Louis:** 516 North Third St. **Agents for Gulf States:** LeSourd & Walpole, Birmingham, Ala. **For California, Nevada and Arizona:** Herron, Rickard & McCone, San Francisco and Los Angeles. **For Washington and Idaho:** Hallidie Machry. Co., Seattle and Spokane. **For Oregon:** Portland Machinery Co., Portland. **For Colorado:** Hendrie & Bolthoff Mfg. & Supply Co., Denver. **Agents for Canada:** The Canadian Fairbanks Co., Ltd., Montreal, Toronto and Vancouver. **Japan:** F. W. Horne, 70-C Yokohama. **Italy:** Ing. Ercole Vaghi, Milan. **Germany:** F. G. Kretschmer & Co., Frankfort a.M. **Austria-Hungary:** E. Krause & Co., Vienna, Prague and Budapest.

(*See page* 48)

Methods of Motor Construction

By D. D. Myers

Details of the construction and work of a drilling and boring jig set in a permanent concrete base.

Fixture used for boring out crank- and cam-shaft bearing holes and a unique boring-bar support.

Method of lining up connecting rods, piston pins and pistons.

A cam-grinding fixture and the way cylinders are bored and faced.

Since the automobile industry assumed proportions which made the production of a number of duplicate machines possible, the aim of every manufacturer has been to secure uniformity and interchangeability of parts. In the average car there are between four and six thousand separate parts, all of which must be assembled by hand labor. When this is considered it is readily seen that assembling is a large factor in the cost of production and it has been the endeavor of the manufacturer to decrease this time as much as possible and to avoid, as largely as is consistent with good practice, the use of hand-fitted parts. Automobile motors are possibly as accurate machines of their size as are built. No essential dimension is allowed to vary over 0.001 inch, and some are even maintained at one-half that. Any variation must be corrected by tedious hand methods, which must be avoided if the cost of production is not to be excessive.

In furnishing parts for repairs, too, exact interchangeability must be maintained as only a few repair shops are equipped with machinery which is accurate enough for making changes, and if the car happens to be in an isolated locality, an imperfectly fitting part is absolutely worthless.

It is only by the employment of the most accurate machine tools that the required standard may be maintained, and wherever possible the machines are automatic. Templets are used for drilling and as a further aid, jigs are employed to eliminate the possibility of errors on the part of the operators.

The Inter-State Automobile Company's factory, at Muncie, Ind., is particularly well equipped with jigs for machining the different parts of the car, by means of which uniformity is secured in any number of duplicate parts. While jigs and templets are used throughout the construction of the entire car, this description is confined to those used on the motor only, as they show the most originality in design and ingenuity in construction.

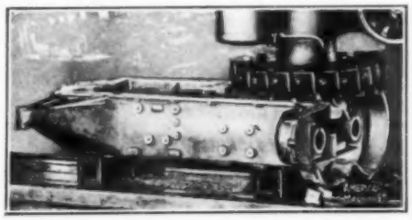


FIG. 1. THE FIRST OPERATION ON A CRANK CASE

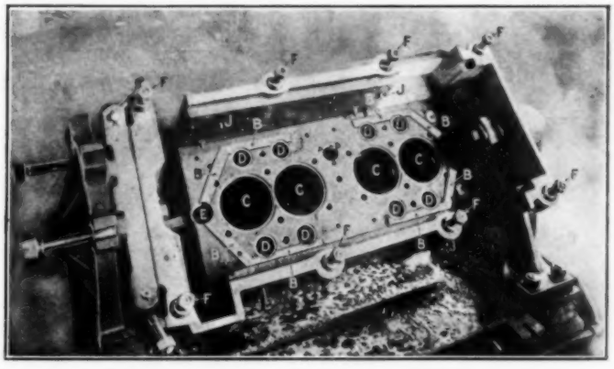


FIG. 2. DETAILS OF THE INSIDE OF CRANK-CASE JIG

FIG. 3. THE WAY THE CASE IS PUT IN; A CRANK CASE AND THE JIG COVER

These jigs are largely completed before the season's output is under way, so that uniformity of all motors is assured.

The photographs, with two or three exceptions, show the jigs which are used in the construction of a 50-horsepower T-head motor. The exceptions show steps in the manufacture of a smaller one, but as the methods and jigs are similar for both motors, they may be applied to either with few changes in the design of the jig.

AN INDEXING JIG FOR CRANK-CASE WORK

Fig. 1 shows the first operations on a crank case, which also is the only machining operation that is performed without the aid of a jig or a templet. The surfaces for the cylinders, crank-case cover and bearing caps are milled off, measurements being made from the rough cam-shaft bearing holes. The two surfaces are milled absolutely parallel and act as guides for all further operations.

Fig. 2 shows the crank-case drilling jig with the case and cover removed. It consists principally of the body *A*, which receives the case, and is so mounted upon trunnions that it may be indexed, and the top; bottom and both sides of the case in turn brought uppermost, and all holes drilled without resetting. The machined surface of the crank case rests on the finished strips *B B* in the bottom of the jig. The large bushed holes *C C C C* are for locating the holes for piston clearance, and the smaller ones *D D* are for the push-rod guides. *E* is for the front motor-support eye-bolt hole.

Fig. 3 shows the operator placing the case in position in the jig and shows the ready accessibility of the fixture. The case is turned upside down and lowered until the finished surface of the casting rests upon the planed strips in the bottom of the jig, which accurately locate it in the proper vertical position, care being exercised to see that no chips interfere with the proper seating. The cover *G* is then placed in position and lowered over the studs and nuts *F F F F*, until it is properly located by hardened dowels, and then notched strips *I I*, Fig. 4, are slipped into place by means of the two levers *H H*, which push them

outward, and the nuts screwed down, clamping the cover firmly in place. It will be noted that the use of the notched clamping strips does away with the necessity of removing the nuts from the studs, which saves considerable time.

Setscrews *J* project through the body and cover of the jig, and by tightening these until they press against the crank case, it is securely clamped and any movement during the operation is prevented.

The body of the jig is held in position by the pins *K K*, which project through bushed holes in the trunnion bracket *L*. An additional clamp *N* is provided, which engages with the forks on the bracket, to hold the jig firmly while drilling the holes for the motor-supporting bolts in the arms, and also, while cutting out the piston-clearance holes, a brace *M* is extended from the iron base to the cover and held in position by pins which may be readily removed while indexing.

The jig is permanently mounted upon a concrete base within the radius of the arm of a radial driller, the universal movement of the arm enabling the operator quickly and accurately to bring the drill above the opening in the cover or body of the jig, and no time is wasted shifting the heavy casting and jig about.

The drill spindle is fitted with a Wizard quick-change chuck, and no time is lost in stopping and starting the machine. All the smaller-sized drills are fitted with collets for use in this chuck, but the larger drills, reamers and the milling cutters for machining the piston clearance holes, are fitted with standard taper shanks.

There are, in all, 87 holes drilled in the case of this jig. Eight of these holes are reamed, and five are drilled with a second drill, making in all 100 different operations. These operations require the use of eleven drills, one reamer and one cutter, and the tools are changed 18 times. The total time required for the operation is 1 hour and 25 minutes. On the few cases which were machined before the jig was completed, the time required for laying off and drilling was never less than 15 hours, and the inaccuracies which resulted made the operation very unsatisfactory.

The drills are lubricated by a compound which is supplied by a belt-driven centrifugal pump from a tank set in the floor at one end of the base, into which the lubricant drains back from the catch pans under the jig.

Fig. 5 shows the jig in position for boring out the crank-clearance holes and the boring tool used is shown in the driller spindle.

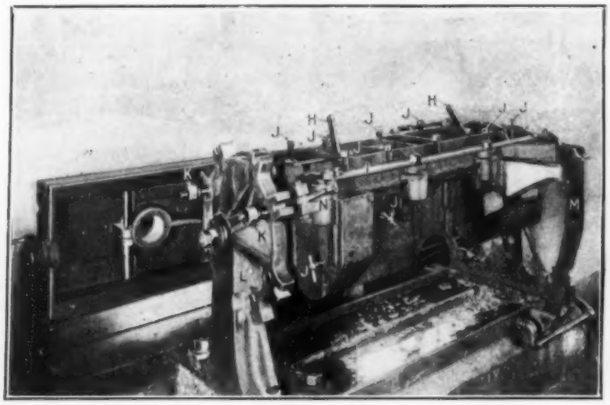


FIG. 4. THE TOP IN PLACE, SHOWING NOTCHED LOCKING STRIPS AND STEADY BRACE

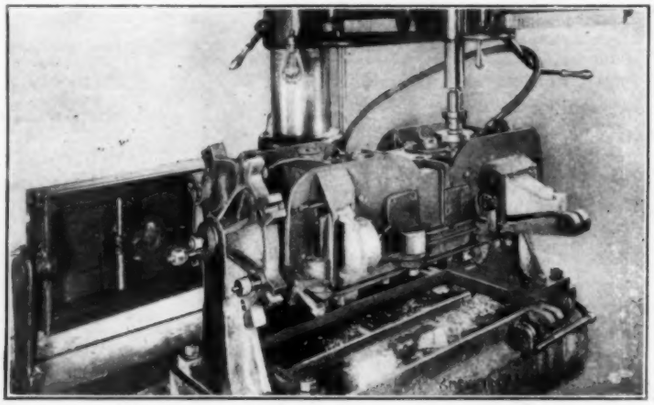


FIG. 5. JIG BOX REVERSED FOR BORING THE CRANK-CLEARANCE HOLES

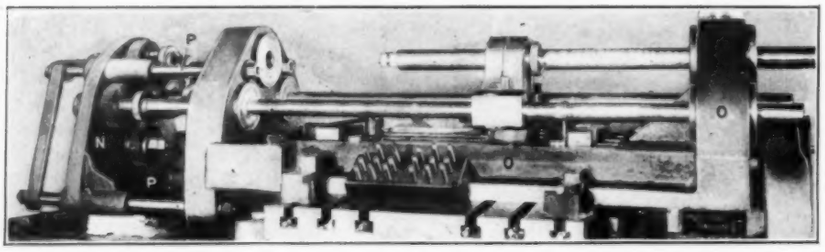


FIG. 6. CRANK- AND CAM-SHAFT BEARING HOLE BORING FIXTURE

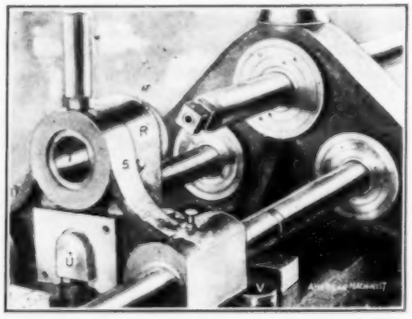


FIG. 7. DETAILS OF BORING-BAR SUPPORT

BORING OUT THE CRANK- AND CAM-SHAFT BEARING HOLES

Fig. 6 shows the fixture for boring out the crank case to receive the crank- and cam-shaft bearings. The essentials desired are to secure perfect alinement, properly space the crank-shaft bearings

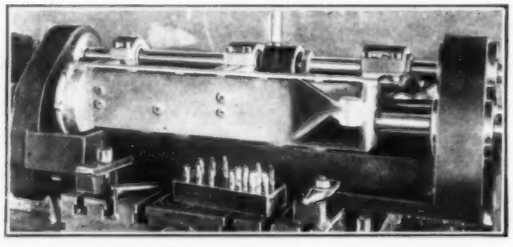


FIG. 8. BORING FIXTURE WITH CASE IN POSITION

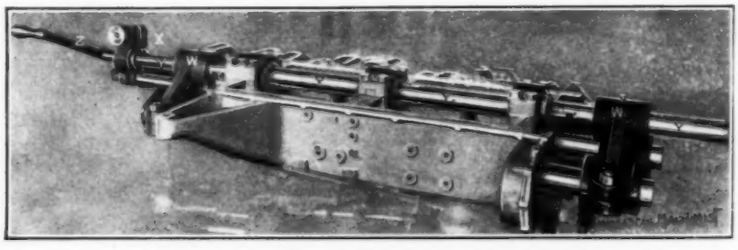


FIG. 9. HAND-OPERATED BABBITT BORING FIXTURE

and to preserve the proper relative location of the crank- and cam-shaft centers. Disalinement of bearings results in undue wear on the bearings, or if serious enough to cause bending of the shaft, crystallization and breaking of the latter and the spacing of the crank-shaft bearings is important if the crank shaft is to be properly fitted. If the location of the bearing centers is not absolute, improper meshing of the timing gears will result, causing noise and resulting in unsatisfactory wear.

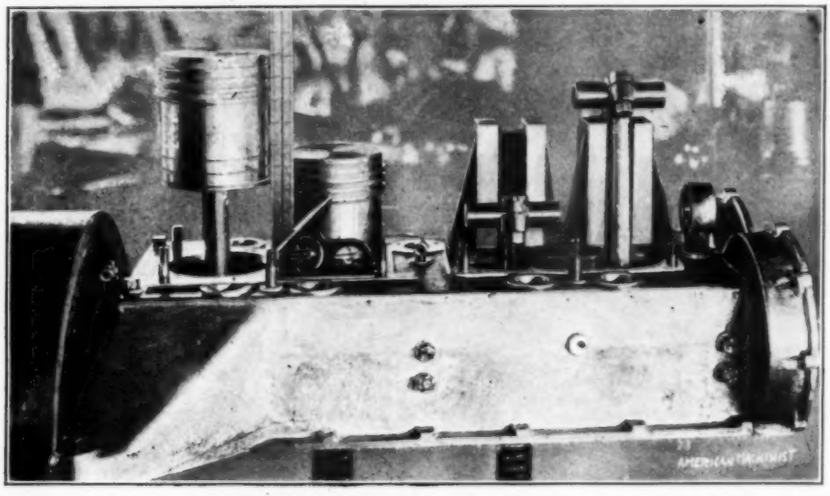


FIG. 10. METHOD OF TESTING ALINEMENT OF CONNECTING RODS, WRIST PINS AND PISTONS

The fixture consists principally of the body *O*, which is mounted upon the table of a horizontal boring mill and is machined on its upper surface to receive the crank-case casting. Bosses *V V*, Fig. 7, are provided, which engage with the holes for the push-rod guides in the case and perfect alinement is automatically secured. Clamping bars are used to fasten the case securely to the fixture.

The boring is performed by bars which are provided with bearings at three points. At each end the bar is supported by two annular ball bearings, which are housed in a steel case or bushing in the body casting. Either bearing may be removed in case of wear by unscrewing a locking nut, which feature insures absolute accuracy at all times, as the wear upon the bearings is practically nothing.

AN UNUSUAL BORING BAR SUPPORT

The center bearing is of particular note owing to the unique construction. To secure rigidity in this bearing, it is evident that it must be immovably fastened to the bed. Owing to the method of machining, it was necessary to invert the crank case, bringing the crank-shaft bearing caps uppermost, and this made it imperative that the center rest be brought up through the piston-clearance port which answered admirably for the rest for the bar used for boring the crank-shaft bearings, as they were directly over the center line of these openings, but as the distance between the cam-shaft bearing centers was greater than the diameter of these ports, some other method had to be devised for supporting the cam-shaft bearing boring bar and the halftone shows the solution as evolved by the Inter-State tool designers.

The rest proper, *R*, is permanently fastened to the bed of the jig and is bored out to receive the bushing *T* which is removable and extends through the opening in the cam-shaft boring bar bearing support *S*. This allows the support to be lifted clear of the rest when the bushing is withdrawn. A clamping bolt, the head of which is shown at *U*, securely fastens it to the rest *R*. The support carries the bushings and acts as a rest for the cam-shaft boring bar. In operation, the crank case is placed on the bed, the clamping bars put into place and tightened down, and the support *S* lowered until the opening for the bushing *T* coincides with the one in the rest *R*. The bushing is then introduced holding the support in position and the clamping bolt is tightened.

The boring bars are ground 0.005 of an inch less in diameter than the opening in the annular bearings or in the bushings, allowing them to slide freely, yet not having enough play to cause chattering or uncertainty in the size of the bore. They are squared at one end to fit into a quick releasing chuck on the driving spindle, carried on the driving head.

The cutting tools are made up of round stock and have a locating and clamping hole which receives the point of a dog-pointed setscrew. When the tools are made, the pieces of stock, slightly longer than is required for the finished cut, are drilled to receive the setscrew, carefully hardened and ground to fit exactly the opening in the boring bar. They are then assembled in the bar and ground to the exact length of the diameter of the holes which they are to bore. They are then removed and ground with the proper clearance and in replacing them, care is exercised to put them in the bar in the same position in which they were originally ground.

A roughing cut is first taken, then a finishing one, and as three tools are used in each of the three bars at each operation, eighteen boring tools are required.

The facing off or spacing of the ends of the crank-shaft bearings is performed with a separate bar, which is drilled for six cutters instead of for three, as are the others. The holes are accurately spaced so that the cuts are made simultaneously and no time is lost in measuring each one.

In operation, a facing tool is set in the forward one of each pair of holes and the bar advanced until the forward side of the center bearing is faced off to a point determined by the distance from the fore-and-aft center line of the case. This also

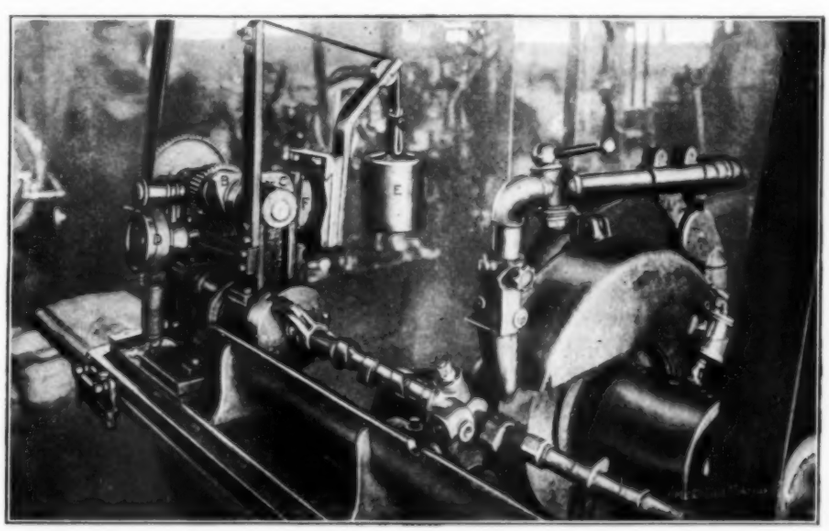


FIG. 11. CAM-GRINDING FIXTURE

faces the front side of each end bearing. The cutters are then removed, another set placed in the other set of holes and the bar is fed in until the length of the center bearing is determined to be correct.

The bars are moved laterally by the movement of the driving head *N*, Fig. 6, which is supported on four guide bars *P*, extended from the body of the jig for this purpose, and is in turn advanced by the movement of the spindle of the boring mill. Power is transmitted from this spindle to the boring bars through a chain of spur gearing mounted on the driving head as shown.

Fig. 8 shows a crank case in position on the jig with the bars in place and the various cutters used are shown in a block on the cross slide.

A Hand Operated Boring Machine

Fig. 9 shows the device used for boring out the crank-shaft babbitts after they have been assembled in the case and the caps put on to correct any variation in size or alinement of them. In "spotting" or fitting the crank-shaft bearings in the usual way, a great deal of time is consumed in lining up, owing to variation in the size of the die-cast babbitts which must be tediously cut away with hand scrapers, and it was to lessen this labor that the fixture illustrated was designed.

Two bars which exactly fit the holes previously bored out for the cam-shaft bearings, are run through and the two end brackets *W W* are clamped immovably upon them where they extend through the case. The boring bar *Y* is carried in bearings in these brackets which are accurately spaced from the cam-shaft bearing centers, which insures the correct position of the crank shaft. The boring bar is turned by means of the handle *Z* and the feed is made automatic by means of the split-nut clamp *X* which engages with the threaded portion of the bar and may be released to allow the bar to be withdrawn.

The cutters are clearly shown in the bar and are held in position by dog-pointed setscrews. As a very light cut only is taken, no crowding of the tool results and the bearings are left perfectly true and as a result the hand fitting is greatly expedited, about one-third of the time formerly devoted to this operation being saved.

Method of Lining Up Pistons and Connecting Rods

Fig. 10 shows the methods used for lining up the piston and piston pins and is indicative of the care exercised in all departments for insuring extreme accuracy in the motors. It is absolutely imperative that the center line of the piston pins is parallel to that of the crank shaft, as thrust is imposed upon the cylinder walls and a great deal of power absorbed by friction if these conditions are not rigidly observed.

The first position on the right is used for determining whether the connecting rod is bent out of a plane at right angles to the center line of the crank shaft. The distance between either end of the piston pin and the jig immediately below it is measured and the rod bent to correct any difference. The next operation is to remove the twist in the connecting rod and is performed in much the same manner, the measurements being made from the perpendicular surfaces instead of from the horizontal ones. The third operation or the one on the left, is merely a checking operation to prove the accuracy of the first two measurements. With this position accurately determined no uneven wear will be given the piston or cylinder walls.

Grinding Solid-forged Cam Shafts and Cams

Fig. 11 shows the head which is used to grind the forged cam shafts for the 40-horsepower motor. The master cams *B* and *C* are held in turn against the stop *F* by the weight *E* and cause the table upon which the centers are mounted to oscillate, grinding each cam the same in outline as the master cam. The cam shafts are rough ground, hardened and then finish ground and the plane bearings ground to size.

The master cams and camshafts are rotated by the belt on the grooved pulley *D* and are turned simultaneously by means of spur gearing. The difference between inlet and exhaust cams is clearly shown by the two master cams, as the cams upon the shaft are identical in outline but reduced in size.

Fig. 12 illustrates the operation of machining the valve chamber and valve-stem guide opening in a cylinder. The cylinder is placed in the jig and held down by studs which extend through the cylinder stud holes. The boring is performed by drills and tools which are driven by the spindles of the four-spindle driller upon the table of which the casting is carried. The valve chamber is machined out for the entrance of the valve plug and the valve opening under the seat cut out at one operation by a tool which carries two cutters and which is held in position by hardened bushings in the frame. The drill for drilling the hole for the valve-stem guides is run through a bushing which fits within the bushing in the jig and in this manner absolute alinement of the valve stems is secured. The threading of the bore for the valve plug and the machining of the valve seat is done on another machine.

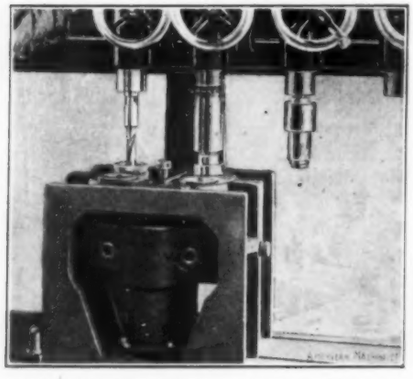


Fig. 12. Valve-hole Jig and Tools

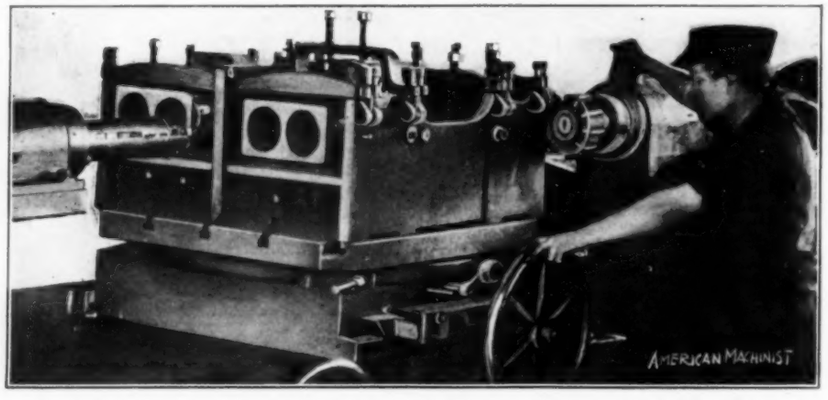


Fig. 13. Facing Ends and Boring Cylinders

The cylinder castings are bored and the bottom milled off to fit the crank case in a Beaman & Smith boring and milling machine, fitted with the usual type of jig used for this purpose, which holds four cylinder "pairs" or castings, which are located and held in position by setscrews and clamping bars. Two castings are placed in the jig side by side with the cylinder bores opening outward and clamped. A milling cutter which is carried on a movable head is fed across the face of the jig and the projecting cylinder casting machined to fit the crank case. The jig is then revolved a half turn and the cylinder castings brought into position before the two boring spindles. These spindles are so spaced that one cut is taken in each cylinder without resetting the jig. A roughing cut is taken, the spindles withdrawn, and the jig set over so that the unmachined bore in each cylinder casting is opposite the boring

spindles. The roughing cut is made, the spindles withdrawn, and the finishing cutters substituted for the roughing ones. While the boring is being done, the milling cutter machines the bottom of another set of cylinders on the opposite side of the jig, which are in turn revolved and the boring operation performed, the cylinders which have been finish bored being removed and rough castings substituted.

This method permits of one operator attending what is practically two machines, removes the necessity for a second lining up of the cylinder casting, and saves the time consumed by the milling cut, which is performed without delaying the boring operation.

An Indicator for Use in the Miller

By E. M. King

The evolution of an indicator for use in machines, the spindles of which rotate while the work remains stationary.

The accompanying illustrations show an indicator for horizontal or vertical millers, boring machines, drillers or other machine tools, in which the boring or cutting tools rotate and the work does not rotate. Its use is to aid in positioning a center-punch mark in a piece of work, in line with the axis of the live spindle of such machine tool, usually for the purpose of boring a hole.

The indicator proper *O*, Fig. 1, was shown in the holder in which it is used for lathe work and also in another holder or attachment used in the milling-machine spindle for indicating up a button, in connection with my article on master plates which appeared in the AMERICAN MACHINIST, page 927, Volume 30, Part 2, and a dimensioned drawing of it in this paper, page 245, Volume 31, Part 1, so that here I think it will only be necessary to consider the attachment shown.

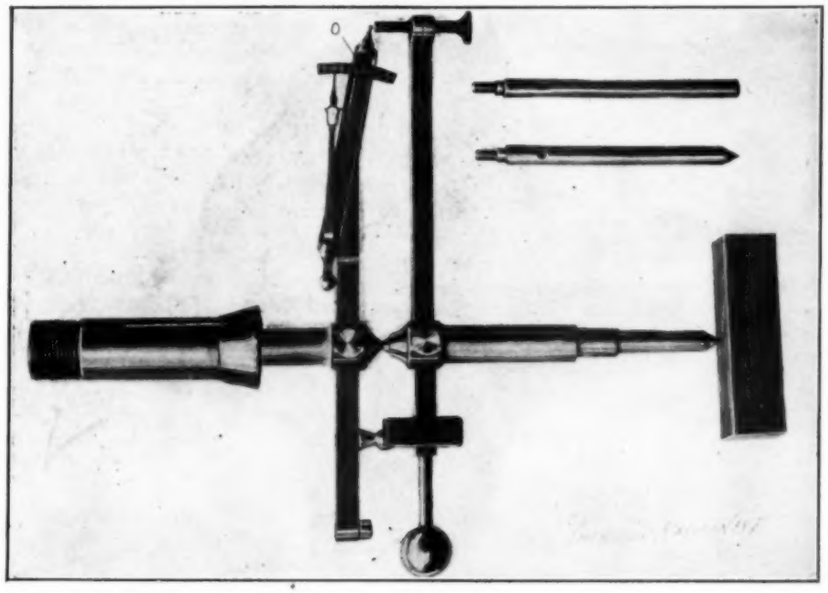


FIG. 1. THE INDICATOR

PRINCIPLE

Let us first look into the principle on which it works. In Fig. 3 *A* is the end of a machine spindle, *B* the faceplate, *C* the male center, *H* the work it is required to bring into correct position, *E* an arbor having a female center in one end to fit *C* and on the other end a male center or point *G* to fit into the punch mark in the work *H*, *D* is a faceplate or disk faced off true on the arbor *E*. If the point *G* be in line with the axis of the machine spindle *A* the faces of the disks *B* and *D* will be parallel to each other, both being at right angles to the same straight line, and the feeler *N* will contact with *B* all the way round when the arbor *E* is rotated. But if the point *G* is not in line with the spindle *A* the plates *B* and *D* will not be parallel but stand as shown in Fig. 4. The work *H* or the machine table on which it is held is now adjusted until the plates are parallel when the point *G* will be in line with the spindle *A*.

We have thus far assumed that both the faceplate *B* and the center *C* are true with the spindle *A*. This condition is necessary only if we wish to allow the spindle *A* to remain stationary, for, by turning the spindle and the plates *B* and *D* together, that is, keeping the screw *N* on or facing the same point *J* on *B* it is not necessary that either the faceplate *B* or the center *C* run true. This is shown in Fig. 5 where the point *G* is in alinement with the machine spindle but the faceplate and center as shown by the full lines are far from being true. The dotted lines show the conditions when the spindle and plates are all turned through half a rotation. It will be seen that the point of the screw *N* stands, in both positions, in exactly the same relation to the point *J*.

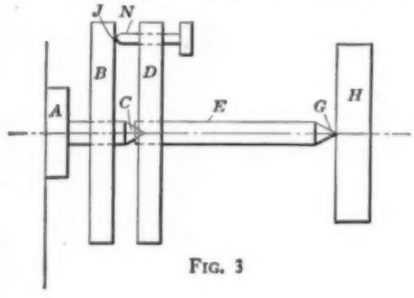


FIG. 3

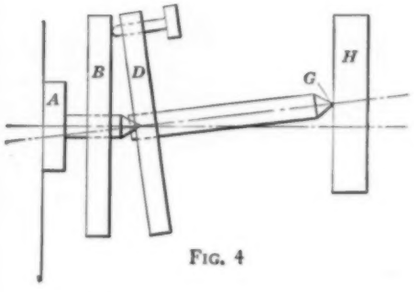


FIG. 4

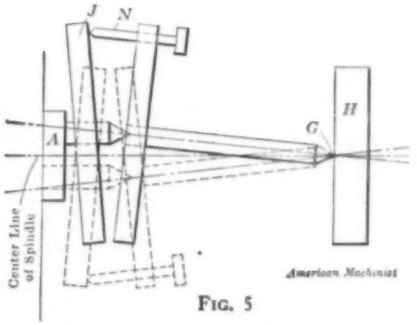


FIG. 5

THE PRINCIPLE OF THE INDICATOR

The indicator attachment is so plainly shown in the illustrations, Figs. 1 and 2, that little description will be necessary. The dimensions given on Fig. 2 are taken mostly from the indicator shown in Fig. 1, but some are changed slightly in

order to lessen the distance necessary between the work to be indicated and the end of the machine spindle. The rods *B* and *D*, Figs. 1 and 2, take the place of the disks *B* and *D*, Figs. 3, 4 and 5. One end of *B* is made to hold the indicator *O* and on the other end is a hardened contact piece *J*. The rod *D* is drilled and reamed to fit the sliding rod of the balance weight *M* and the end slit to give friction to hold the weight in any desired position. This balance weight is made from a steel bearing ball. The piece *L* should be machined carefully to fit snugly on the rod *D* and to allow the ball *K* to move freely but without shake. The part *F* should be a nice sliding fit in *E*.

Method of Using

In practice it is well for approximate setting of the work not to use the indicator proper *O* but adjust the rods *B* and *D*, making the screw *N* and contact piece *J* come together, as far out as possible from the center *C*, then turn the machine spindle by hand half way round and try if the points *N* and *J* now touch and so on until the work is approximately in position. It is quite easy to locate the work well within 0.001 inch by this method without using the indicator *O*. If the machine tool is so large that the spindle cannot well be turned by hand it may for this rough setting be run continuously by power and the rod *D* moved round by hand and adjustments of the work made until the screw *N* contacts with *J* in all positions around the circle.

When using the indicator *O* a small mirror will be necessary in order to read the scale in the different positions as the spindle is being rotated.

How the Attachment Was Evolved

This attachment is not submitted as a model of the tool designer's art. It was made to suit the indicator *O* which I already had, and from such materials and with such tools as happened to be most convenient, then additions and alterations were made from time to time as found necessary. The device was first made for use on a vertical-spindle miller. A U-shaped piece of steel spring somewhat like the part *L*, Fig. 2, but lighter and long enough to slip over both rods served as a dog to drive the rod *D* around with *B*. This arrangement worked fairly well, but on coming to use it in the horizontal spindle machine it was unsatisfactory. Owing to the U-shaped piece having to fit rather loosely in order to allow of the necessary free movement of the rod *D* it permitted the contact screw *N* to drop away from, or change its position relative to the contact point of the indicator *O*. The rod *D* was then drilled out and the balance weight added, which helped considerably but not enough. The ball *K* was then added and the piece *L* made much more rigid. It was then found that it was not really necessary to use the balance weight, though it is preferable to do so.

I do not particularly recommend this method for use in accurate master-plate or jig work, not because the indicator is not to be relied on, but because of the difficulty of making a center-punch mark where it is wanted, with any great degree of accuracy. However, there are many places, particularly in model and experimental work where it is very easy to make a punch mark with sufficient accuracy where it would be impracticable to set a button. Such work is usually done on the lathe faceplate and many times the amount of time spent in doing it that would be necessary if done on the milling machine. This is particularly true of heavy- or irregular-shaped pieces, and machine parts that are in place and which could be operated upon without being removed from their machine if the milling-machine method is used.

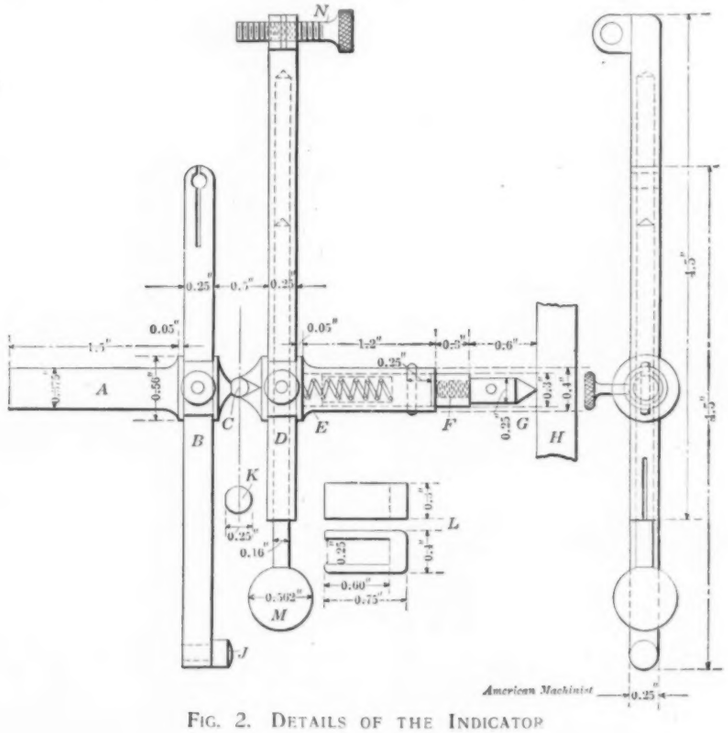


Fig. 2. Details of the Indicator

Report of A. S. M. E. Committee on Identification of Power House Piping

a In the main engine rooms of plants which are well lighted, and where the functions of the exposed pipes are obvious, all pipes shall be painted to conform to the color scheme of the room; and if it is desirable to distinguish pipe systems, colors shall be used only on flanges and on valve fitting flanges.

b In all other parts of the plant, such as boiler house, basements, etc., all pipes (exclusive of valves, flanges and fittings) except the fire system, shall be painted black, or some other single, plain, durable, inexpensive color.

c All fire lines (suction and discharge) including pipe lines, valve flanges and fittings, shall be painted red throughout.

d The edges of all flanges, fittings or valve flanges on pipe lines larger than 4 inches inside diameter, and the entire fittings, valves and flanges on lines 4 inches inside diameter and smaller, shall be painted the following distinguishing colors, numbered 1 to 12, inclusive:

DISTINGUISHING COLORS TO BE USED ON VALVES, FLANGES AND FITTINGS

Steam division	*a*	High pressure—white
	b	Exhaust system—buff
Water division	*c*	Fresh water, low pressure—blue
	d	Fresh water high pressure boiler feed lines—blue and white
	e	Salt water piping—green
Oil division	*f*	Delivery and discharge—brass or bronze yellow
Pneumatic division	*g*	All pipes—gray
Gas division	*h*	City lighting service—aluminum
	i	Gas engine service—black, red flanges
Fuel oil division	*j*	All piping—black
Refrigerating system	*k*	White and green stripes alternately on flanges and fittings, body of pipe being black
Electric lines and feeders	*l*	Black and red stripes alternately on flanges and fittings, body of pipe being black

[Although this color scheme is intended, as indicated in the title, primarily for power-house pipe it can be used to advantage for all the piping in an industrial plant and the subject is one well worth serious consideration.—Ed.]

To estimate the rated horsepower of a steam engine, square its cylinder diameter in inches and divide by 2.

Drilling Fifty-four Holes at Once

By S. E. Watkins

A special horizontal driller used in conjunction with a standard radial that drills 54 holes, from three different directions, at once.

Details of jig plates that are used for more than one job.

The machine is easily run and the work handled by one machinist and a helper, in record time.

The accompanying halftone, Fig. 1, shows a special horizontal driller used in connection with a 7-foot radial driller for drilling duplex air-pump or steam cylinders. The machine consists of a bed with two upright columns which are adjustable both transversely and longitudinally and the drill heads with power feed and back gears are adjustable vertically on the columns.

Power is supplied to the horizontal machine by a 20 horsepower variable-speed motor, which may be seen in the background at the right, through a rawhide pinion and a large spur gear, to be seen at the extreme right, which is on a shaft running the entire length inside of the bed, and from this shaft to each drill head by a train of spur gears, horizontal shaft, bevel gears and vertical shaft. Each drill head, right and left hand, is fitted with a multiple drill head carrying 24 drill spindles, each capable of driving a 11/16-inch drill. The multiple drill head is supported on slideways, which carry their whole weight and hold their heads in perfect alinement. The multiple drill spindles are all gear driven and run at a speed of about 55 feet.

The jig consists of a bed piece which is firmly bolted to a suitable hight block or table and has two upright side plates, right and left hand, each with its layout of drill bushing, one of which is shown in detail in Fig. 2. In this cut the outer circle, right hand, and inner circle, left hand, are used for air cylinders and the inner circle, right hand, and outer circle, left hand, for steam cylinders, the layouts in both plates being the same.

To the right-hand plate of the jig, which is rigid, is hinged a leaf shown in Fig. 3, carrying six bushings. The left-hand plate of the jig is carried on suitable gibbed slideways, and is operated by links, rock shaft and lever, to be seen at the front of the jig, Fig. 1, and each plate of the jig is supplied with two expansion fittings, operated by hand wheels, which accurately locate the work in the jig.

Easy to Change Drill Heads

The multiple drill head used in the vertical spindle is so constructed that two of the drill spindles with their bearings are easily removed and replaced by two others, making a different layout, as

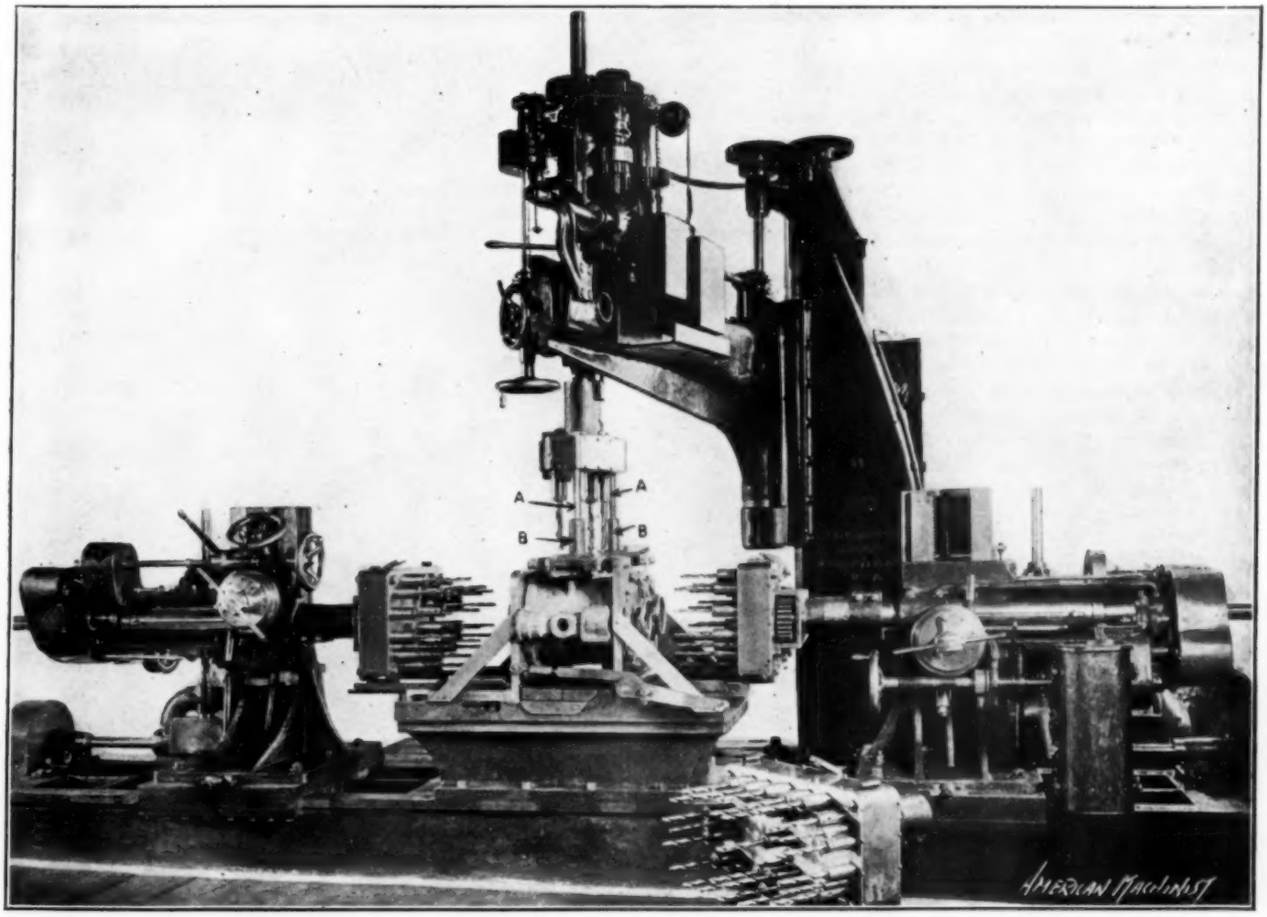


Fig. 1. Combined Horizontal and Vertical Driller for 54 Holes

shown by line drawing of the leaf of the jig, Fig. 3; in one case, holes *A, B, D* and *E* are used and in the other holes *A, C, D* and *F*. The tendency of this drill head to twist around, owing to the power exerted on the drills, is overcome by two studs or plungers, Fig. 1, which are a

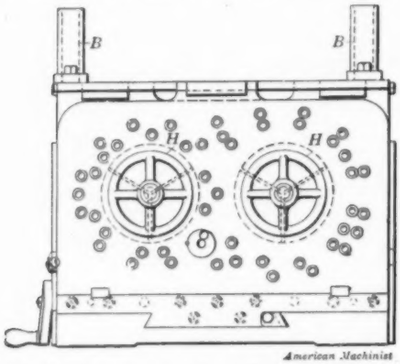


FIG. 2. LAYOUT OF SIDE PLATE OF MULTIPLE-DRILLING JIG

close sliding fit in sockets *B*. The studs *A* and sockets *B* being very rigid, will correct any slight error in the position of the arm of the radial, when the drills are brought down to the work and they also relieve the drills of all undue strain.

By means of a pneumatic cylinder, not shown, the arm of the radial is swung out of the way and the leaf of the jig raised, or brought back to position at the will of the operator.

The machine, as set up in Fig. 1, is for drilling the air cylinder, which has 22 5/8-inch top and two 21/32-inch dowel holes in each end and also four 1/16-inch holes in the bolting lugs, the drills for which, 52 in all, are working simultaneously at near the maximum speed and feed.

The steam cylinders are drilled in the same jig by changing two of the expansion fittings and the two multiple drill heads for two others, one of which is shown in the foreground, Fig. 1, and also changing two spindles in the vertical multiple drill head, as referred to previously. The steam cylinder has 23 tap and two dowel-pin holes in each end,

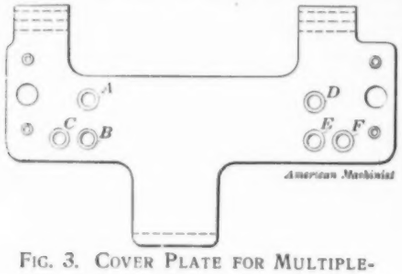


FIG. 3. COVER PLATE FOR MULTIPLE-DRILLING JIG

also four holes in the bolting lugs, making 54 holes, all of which are drilled simultaneously.

By different combinations of drill heads and expansion fittings, the same jig and machine drills all of the holes in the center piece, steam head, cylinder head, steam and air cylinders, which are the five principal castings used in an air pump.

To remove a casting from the jig, the radial is swung to one side and the leaf of the jig raised, by the pneumatic hoist referred to above; the expansion fitting released; the jig opened by the hand lever and the casting removed with the aid of a light crane. A new casting is put in by reversing the operations.

This machine is run by one machinist and one helper. The radial is motor driven and both are controlled by the operator at the right-hand end of the machine; the controller box being in plain sight. The total time for drilling a cylinder with the 52 or 54 holes is a little less than 4 minutes, floor to floor.

The machine described is one of several designed by C. P. Topping, master mechanic of the New York Air Brake Company's works, Watertown, N. Y.

Nurling in the Drop Press

BY E. A. DIXIE

Fig. 1 shows the nurling or checkering on a Utica plier handle made by the Utica Drop Forge and Tool Company, Utica, N. Y. This is in more ways than one a new departure. Not only is it unusual to nurl the handles of pliers, if one excepts similar tools used by surgeons and dentists, but the form of nurling is different. The usual nurling is similar to "checking" or "checkering" done on gun stocks. In this the lines are cut in at an angle to each other, leaving angular pyramids of metal. In appearance this style may by some be considered superior and for such work as gun stocks no doubt is so, but for pliers, which are in constant use and gripped tightly by the hand, the style shown in the halftone is better. It not only gives as firm a grip but the raised lines running at an angle to each other present more surface to the hand and do not hurt (as do the small sharp pointed pyramids) when firmly grasped. The dies for producing this style of nurling are also more simple to make.

Fig. 2 shows the way the die is made. The impression is first worked out smooth in the usual way. The angular cutter *A* is then mounted on the arbor and the die block *B* is secured in the vise which has been set at the correct angle. The cutting of the die is then merely a series of operations of the cross, the long and the vertical feeds of the miller table. After the lines running in one direction have been finished the vise is thrown around for the other set. The burs are then cleaned off with a riffle and after covering the surface with file cutters' paste to protect the impression, the die is hardened. The drop-forged pliers are sand blasted to remove the scale and a single drop finishes the checking.

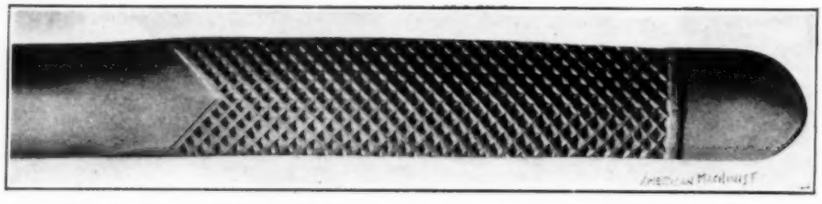


FIG. 1. CHECKERED HANDLE OF A UTICA PLIER

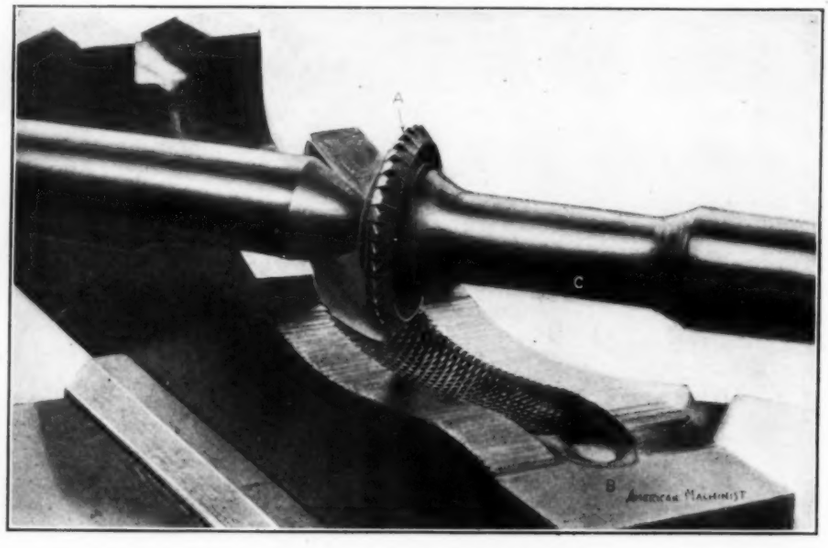


FIG. 2. THE CHECKERING DROP DIE

Manganese and Silicon in Foundry*

By A. E. Outerbridge, Jr.

The influences of several important elements in the manufacture of iron in overcoming brittleness and securing solid castings.

*Read before meeting of the American Foundrymen's Association.

In order that the progressive foundryman may clearly comprehend the remarkable influence that these and a few other elements exert (even when present in extremely minute quantities sometimes) upon iron, it is necessary that he should realize at the outset that iron when pure is always the same, physically and chemically, no matter from whatever source it may be obtained, and that all of the multitudinous variations the commercial metal exhibits, may be traced directly to the effects of combinations with a few other elements. In its pure or nearly pure condition iron is an exceedingly ductile metal which may be forged and hammered, or rolled, into very thin plates, ribbons or bars. Such bars may be bent double while cold, or tied into bow knots. The tensile strength is comparatively low, being approximately 50,000 pounds per square inch and the metal melts at a temperature between 3000 and 3500 degrees Fahrenheit.

The addition of a very small amount, or less than one-half of 1 per cent., of carbon (whose melting point is so high it has never been determined) lowers the melting point several hundred degrees and converts the metal into what is known as "mild steel," changing many of its characteristics and greatly increasing its tensile strength.

The addition of 1 per cent. of carbon gives us high-grade carbon "tool steel," having tensile strength frequently of upward of 150,000 pounds per square inch, and possessing other new valuable properties.

By still further increasing the proportion of carbon the saturation point is passed and "cast iron" results therefrom. The tensile strength is again reduced and the melting point is still further lowered, the metal takes on entirely new characteristics and its chemical composition becomes far more complex by reason of the creeping in of other elements for which iron possesses very strong affinities. The adding of nickel, for example, is one of the comparatively recent developments of immense practical value, yet, strange to say, natural alloys of this nature have been familiar to metallurgists for a century or more, in the large meteorites that have fallen to the earth, perhaps from other worlds than ours.

Manganese in Foundries

Manganese is a metal that for many years was regarded as a deleterious material which ruined the quality of iron or steel, yet this metal proved the salvation of the bessemer process, and more recently Hadfield discovered that the addition of manganese in larger quantity than had hitherto been deemed permissible gave us "manganese steel," one of the most wonderful products known to man, possessing the rare combination of extraordinary strength, hardness and ductility.

About thirty years ago I commenced a long series of investigations with this element in connection with the special kind of cast iron used for making chilled cast-iron car wheels. Formerly such wheels were made entirely from cold-blast charcoal iron, a product peculiarly suited for the purpose. This metal was rich in carbon and comparatively poor in all of the other elements, viz.: Silicon, sulphur, phosphorus and manganese. Good car-wheel iron has approximately the following composition: Carbon, 3.242 per cent.; phosphorus, 0.403 per cent.; silicon, 0.776 per cent.; manganese, 0.391 per cent.; sulphur, 0.083 per cent.

Cast iron for chilled car wheels differs from iron for machinery castings or for general purposes mainly in its comparatively low silicon content, being less than one-half of the amount of silicon ordinarily found in iron castings and less than one-third the quantity often found in light castings, such as pulleys. Nevertheless, the silicon in these good wheels was close up to the maximum amount permissible in chilled cast-iron car wheels having the requisite depth of chill (or white iron) in the tread to insure high mileage.

The chilled cast-iron car wheel is an American invention and the name of Asa Whitney will always be inseparably associated with its history as a pioneer in its development and in its successful introduction in the early days of railroading.

As long as cold-blast charcoal iron was obtainable, little difficulty was experienced in maintaining the product up to the required standard, and it is a remarkable fact that years before the chemical composition of the metal was studied or chemical analysis was used in preparing the melts, wheels were made in which the silicon (which is the most important element of all) did not vary as much as one-half of 1 per cent. from the average amount found by Doctor Dudley in the five good wheels, the explanation being that the foundry foreman was provided with a physical analysis of his metal in the form of "chill tests" made from every tap of the cupola. By this means the required depth of chill was maintained day by day.

In course of time cold-blast charcoal iron became more and more difficult to obtain, "warm" blast was introduced for economy both in the quantity of charcoal fuel and in the time required for reducing the iron from its ore. Instantly the quality declined and then "hot blast" iron, made with anthracite coal, supplanted charcoal iron for almost all purposes, even the making of chilled cast-iron car wheels. This change in practice necessitated the introduction of more scientific methods in car-wheel foundries.

It was well known that manganese caused iron to chill, and as long ago as the year 1880 the custom of introducing a certain quantity of high manganese iron into the cupola in car-wheel mixtures had already attracted attention. The tests which I was called upon in that year to make convinced me that a "manganese chill" on the tread of a car wheel was a spurious chill, very handsome to look at, but poor in wearing properties. The crystals are coarse and lamellar, they "spall out" or break away from each other when subjected to repeated taps with a hand hammer. Moreover, the white iron caused by high manganese in a chilling mixture is comparatively soft and may be drilled without great difficulty. The result of introducing high manganese irons in the cupola proved disastrous in car wheels when put to severe practical tests and the rule was therefore made that a manganese chill must be avoided.

In the course of these early investigations, however, a remarkable discovery was made, almost by accident. I found that if a very minute quantity of powdered ferromanganese was placed in the bottom of a ladle and ordinary car-wheel iron poured upon it several curious things happened: First, a very rapid circular movement, or rather motion in ripples from the edge toward the center of the ladle, was immediately noticeable on the surface of the molten iron, this continued until the iron set, and was even apparent in the gates and risers of castings up to the moment of congealing. Second, when a chill test piece was fractured it was seen that the gray-iron portion was very much darker in color and of more open grain than that of a similar test piece poured from the same iron untreated. Third, the white iron or chilled portion of the test piece showed no appearance of a manganese chill, the only visible change being a slight reduction in the depth of the chill. Test bars were cast from this metal and also from

the untreated iron. An average gain approaching 50 per cent. in tensile and transverse strength was recorded.

Analyses were made by various chemists of drillings taken from the treated and the untreated iron. These all showed that the principal change caused by the treatment had taken place in the condition of the carbon, nearly one-half of the combined carbon had been changed to the graphite form. The sulphur was likewise decreased. The shrinkage of the test bars of treated iron was reduced nearly 30 per cent. as compared with the same iron untreated. Various proportions of ferromanganese (containing about 80 per cent. manganese) were tried, with the final result that the rule was adopted that in each ladle, holding about 600 pounds of iron, needed at that time to pour one full-sized 33-inch car wheel, one pound of powdered ferromanganese should be used. For a number of years this method was adopted only in the car-wheel works of A. Whitney & Sons, Philadelphia, but in the course of time it became generally known and used, and, although my connection with work of this nature ceased in 1887, I believe the method is still very generally if not universally employed.

In an address given at the Franklin Institute in 1888, entitled "Pig Iron and the Relation between Its Physical Properties and Its Chemical Constituents," printed in the *Journal* of the Institute in March of that year, I made my first public announcement of these investigations as follows, in their *Journal* in March, 1888:

"Manganese is commonly supposed to exert a hardening tendency upon pig iron, but experience has taught me to regard this as another mistaken notion, it undoubtedly produces a marked effect upon the character of the white crystalline structure. You may readily recognize 'a manganese chill' by its coarse lamellar or foliated filaments and by the tendency which it produces to form white iron or 'hard spots' in isolated places throughout the gray portion of a casting. Manganiferous pig iron has been used to produce chilled castings, but it does not make a durable wearing surface; the chilled tread of a car wheel, for example, produced by this method, presents to the eye, when broken through the section, a handsome appearance, but the white metal is comparatively soft; it may be easily bored, and, what is more serious, it crumbles readily under the impact of rapid shocks on the rail.

"A remarkable effect is produced upon the character of hard iron by adding to the molten metal, a moment before pouring it into a mold, a very small quantity of powdered ferromanganese, say one pound of ferromanganese in 600 pounds of iron, and thoroughly diffusing it through the molten mass by stirring with an iron rod. The result of several hundred carefully conducted experiments which I have made, enables me to say that the transverse strength of the metal is increased from 30 to 40 per cent., the shrinkage is decreased from 20 to 30 per cent., and the depth of the chill is decreased about 25 per cent., while nearly one-half of the combined carbon is changed into free carbon; the percentage of manganese in the iron is not sensibly increased by this dose, the small proportion of manganese which was added being found in the form of oxide in the scoria. The philosophical explanation of this extraordinary effect is, in my opinion, to be found in the fact that the ferromanganese acts simply as a deoxidizing agent, the manganese seizing any oxygen which has combined with the iron, forming manganic-oxide, which being lighter than the molten metal, rises to the surface and floats off with the scoria. When a casting which has been artificially softened by this novel treatment is remelted, the effect of the ferromanganese disappears and hard iron results as a consequence."

It will be observed from the foregoing that manganese acts in two different and opposite ways in cast iron.

When alloyed therewith in the cupola in considerable quantity, say 2 per cent. or over, it has a chilling and hardening effect, producing what I have termed a spurious chill of coarse crystalline nature, in contradistinction to the normal chill in a good car wheel which has a fine and closely interwoven crystalline structure.

When the alloy called ferromanganese is added in a ladle of molten car-wheel iron in the small quantity given (1 pound of alloy, containing about 80 per cent. manganese, in 600 pounds of iron), it acts not as an additional contribution of 0.133 per cent. manganese to the metal in the ladle, but simply as a deoxidizing and desulphurizing flux, cleansing the metal from impurities, softening it and greatly increasing the ductility and strength without injuring the chilled tread of the wheel.

The fact that ferromanganese was found to be so beneficial in car-wheel practice soon led others to exploiting the alloy for general foundry purposes, but the conditions are here entirely different and in most cases this alloy is not only of no benefit, but is actually detrimental to foundry irons. I have already explained that it changes a large portion of the combined carbon in car-wheel (or chilled roll) iron into the graphitic form, but this remarkable effect cannot take place in ordinary foundry iron which contains usually scarcely more than a trace of combined carbon. The ignorant and improper use of ferromanganese in general foundries is sure to lead to disappointments.

Silicon for Foundry Use

In a pure state silicon may be obtained in three allotropic forms, quite different from each other in appearance and also in some other properties. In this respect it resembles pure carbon, which is found as "graphite," "charcoal" and "diamond." In the amorphous state pure silicon is a brown combustible powder. In crystalline form it has a red luster, and in so called "graphitic" form it resembles graphite in appearance. In recent years silicon has been produced in commercial quantity nearly pure (98 per cent.) by means of the electric furnace, and is used in steel manufacture. Its melting point, however, is so high that it will not dissolve in molten cast iron in a ladle, as I have proved by many tests.

Formerly silicon was regarded as a most undesirable element in pig iron for foundry use, it was thought to produce "blow holes" and to make unsound castings.

When the suitability of pig iron for castings was determined by fracture only, as was the case in my early foundry experience, "silvery pig" or "rotten pig" or "measly pig," as pig iron which was very high in silicon was variously called, was practically an unsalable commodity to foundries, for, when silicon is present in quantity ranging from 5 to 10 per cent. or over, the pig metal becomes very brittle and hard, the fracture is very light gray in color and devoid of the crystalline structure characteristic of good metal. It is indeed totally unsuitable for castings. I well remember the consternation among several foremen when I first introduced a carload of silvery pig iron containing 12 per cent. of silicon to their notice and proposed to use a certain amount of it in the cupola mixture for the purpose of softening the iron and permitting a larger proportion of hard scrap to be incorporated, followed by their astonishment at the unexpectedly beneficial result in the melt. My records show that for several years this high-silicon iron was purchased and used as a regular component in the foundry.

In course of time the views of intelligent foundrymen changed with respect to silicon and therewith coincidently came a change in the practice of pig-iron makers as well. No longer was it considered desirable to keep the silicon as low as possible in foundry irons, gradually the average proportion began to creep up, so that it was not necessary for me to continue to purchase 12 per cent. silicon pig iron in order to obtain the amount desired in our castings, for a sufficient number of brands of iron containing the full amount of silicon desired for our smallest castings could be obtained without difficulty at the ordinary market price of No. 2 plain iron. In fact, the pendulum has now swung the other way and I find it necessary to limit

the proportion of silicon in pig-iron purchases to suit various requirements.

The American Society for Testing Materials has fixed upon certain data with respect to the average proportion of silicon desirable for castings of various kinds, after consultation with foundrymen, metallurgists and chemists, and the information has been widely disseminated in its reports.

While experimenting with ferromanganese added in ladles of car-wheel iron many years ago, I desired to know the effect upon the metal of other similar alloys and therefore obtained the highest grades of silicon alloys then made, irrespective of cost; the richest contained nearly 20 per cent. silicon. It was a disappointment to find that even when this metal was powdered and preheated to redness the influence on the cast iron of the comparatively small amount that could be melted in a ladle of iron without making it dull was almost inappreciable. Similar tests were made with the metal aluminum, which cost at that time $8 per pound; the results were again disappointing.

Since the first publication of my experiments it has come to my knowledge that very impure adulterated material has been sold as 50 per cent. ferrosilicon alloy to foundries. In some cases the sweepings and dross obtained from manufacturers of ferrosilicon alloys have been bought in quantity at ridiculously low prices, mixed with similar refuse from ferromanganese manufacture, the whole being ground together to form a material which is of very poor quality indeed. The temptation to do this is great, the market price of 50 per cent. ferrosilicon is about 50 per cent. higher than that of 80 per cent. ferromanganese and the two alloys resemble each other so closely that when broken into small lumps or grains, or powdered, chemical analysis is the only means of determining the relative proportion of each. The particles of slag, cinder and dirt may be readily seen in the worst samples by the naked eye or by the aid of a pocket magnifying glass.

The foundryman should understand clearly from what has gone before that ferromanganese and ferrosilicon possess entirely different functions in cast iron and should not be used indiscriminately or in conjunction. Ferromanganese is best adapted to the treatment of high chilling iron for car wheels or chilled rolls, or other chilled castings, where the proportion of combined carbon is large.

Ferrosilicon is best adapted to treatment of foundry iron when from any cause it is hard and brittle, since it possesses the peculiar property of softening and at the same time strengthening such iron. It also enables the founder to vary the grade of iron in individual ladles to suit individual castings or groups of castings. It gives the founder control of his iron after it has been withdrawn from the source of melting, a matter of great importance and value, and it enables him to use cheaper grades of iron.

Finally, I wish to say that neither ferromanganese nor ferrosilicon can be regarded as universal panaceas, as some unscrupulous salesmen would have the foundryman believe, and, while each in its proper place is of great value, they must, like all other good things, be used intelligently, and if impure adulterated materials are employed they will not only prove to be of no benefit but may be absolutely harmful.

Need of a Gage for Surface Finishing

By John C. Spence*

When one person tells another that he would like a certain surface ground to a certain finish, he has no means of conveying a definite idea of the surface he wants. He uses such expressions as "fine finish," "commercial finish," "smooth finish," etc. Now, these terms have an entirely different meaning to different minds. It all depends on the previous training a particular mind has had. What is a "fine finish" in one business is only a "commercial finish" in another. For instance, a "commercial finish" in the manufacture of plug gages would be a "fine finish" in the machine-tool business, and what is a "commercial finish" in the machine-tool line the agricultural-machine maker would believe to be a waste of time.

There are several methods of testing a surface finish at the present time. The most common is by eyesight, alone. This requires much experience, as a poorly ground, somewhat chattered surface will look fine to the novice, especially if the surface has been produced by a hard, fine wheel and is bright and shining.

Another method is to clamp a piece of sheet lead onto the surface, if it be cylindrical, and by rubbing with the lead, show the imperfections. This method has the merit of being cheap, but is misleading, as lead, being soft and pliable, will follow the inaccuracies to a certain extent. Also, if the lead is traversed lengthwise of the cylinder, the incuracies of the lead surface will make, marks on the ground surface which will appear to be chatters when, in reality, there are none.

The best test of a cylindrical surface is to lap with a tight-fitting ring. This shows up the apparent imperfections, although these so called "mottles" or "waves" often have such small depth that no measurable difference results when they are entirely lapped out and, so far as actual mechanical practice is concerned, a thing that cannot be measured does not exist.

It is to definitely settle these points that a surface-finish gage is needed.

We can put on paper our desires regarding the chemical and physical properties of a piece of metal. We can even arrive at a fairly indisputable understanding concerning so elusive a quality as hardness, but no one has given us the key to the surface-finish problem. We can designate cloth by the threads per inch, speed by feet per second, electricity by voltage and current, but we have no surface-finish unit. This subject will assume a greater importance as the demands for high speed increase, as it is not at all certain that a highly polished "fine" surface is easiest to keep lubricated.

The discovery of a means of designating surface finish will do away with a whole lot of "old women" decisions that today needlessly hold up production. There is a certain class of mechanics to whom the word *grind* seems to imply perfection and, therefore, any ground surface that shows imperfections, even under a microscope, is not good grinding. On the other hand, the mechanic who recognizes that there is a proper surface for each case in question, just as there are proper diameter limits of each case, is the one who will reap the reward.

If the mechanical world had ever attained perfection in the production of surfaces, we would be wise to question the introduction of a new method and, if that method fell short of perfection, we would be warranted in condemning it. But, since the mission of the grinder is to replace the fine-feed lathe cut and the tedious file, we have simply to ask ourselves: "Is this an improvement over old methods?" If the answer is affirmative, let us be thankful for the fact that the world really progresses, and instead of being "from Missouri," let us all aim to hold the advantage we have gained in cost of production, and not be forced backward by the chimera of "feed lines," "mottles" and other tricks of interfering light waves. If, in holding to this advantage, we can improve the surface through skill, well and good.

*Superintendent, Norton Grinding Company.

While all agree that gas-producer power plants are very economical, we occasionally find cases where they have failed to give satisfaction. In a recent case of this kind the management was on the point of condemning the whole plant until they found a stray flask or two of which the attendant had inadvertently forgot to dispose. Since then there has been no trouble. The only place whisky is really useful around the shop is in a hydraulic jack and, unfortunately, it does not always stay there when it is used.

Handling Heavy Work in the Shop

Western Correspondence

Methods devised by a well known planer builder for facilitating the moving about of beds, platens and other parts, as well as complete machines.

A built-up balancer with a pair of hooks which, in conjunction with two cables, enables a planer to be lifted from the floor and moved by the crane without straining the machine or making it possible for it to slip from its support.

How a heavy bed is lifted by a block at the center, and a long platen picked up with the aid of a link in a T-slot. An overhead, swinging I-beam with trolley and hoist for handling lathe and grinder work.

The problem of handling heavy machine parts about the shop during the process of manufacture, and of moving completed machines from the shop floor to the shipping car is a serious one in many places. Even where adequate crane service is available there is often real difficulty in picking up the casting or machine requiring to be moved, unless special facilities have been provided for attaching the crane hook to the load.

Some important appliances which the Cincinnati Planer Company uses constantly in its shop for moving planer beds, platens, and completely erected planers, are illustrated by the accompanying halftones and line engravings.

Lifting a Planer

The method of picking up a planer complete is represented in Fig. 1, which shows a 30x30-inch by 10-foot machine weighing 12,500 pounds suspended from the crane hook, by means of a device known as a "balancer" which has at each end a hook for a cable passing under the bed of the planer. There are several sizes of these appliances in the shop and planers of all sizes are readily handled with their aid, without danger of injury.

In use the balancer is hung on the crane hook, and the two cables composed of parallel wire strands are passed under the planer bed with two cast-brass shoes between each cable and the lower corners of the bed. A few moments at the most is all the time that is necessary for arranging the slinging apparatus, and the planer can then be picked up without being strained and without liability of slipping during its movement with the crane.

The Suspending Appliance

The sketch, Fig. 2, gives the principal dimensions of the "balancer," and shows the method of riveting the main members, attaching the hooks, the lifting link, etc. The frame is composed of two 16-inch channels, in this case 12 feet in length, with 1-inch tie plates at top and bottom, at each end, and with a lifting link 10½ inches wide by 2½ inches thick riveted between the channels, at the middle of their length. The hooks are formed with 2¼-inch shanks, leaving a shoulder at the top of the hook proper, while the upper ends of the shanks are threaded and provided with nuts which are locked with a set screw and which bear upon a large washer resting upon the top of the channel tie plates.

The brass shoes used under the corners of the planer bed to protect the cable and machine, are of the form shown in Fig. 3. The diameter is about four inches, the length about one foot. One-quarter of the circle is omitted in the pattern and this enables the shoe to rest squarely against the corner of the bed when the cable is drawn up taut by the crane.

One of the flat faces of the shoe is provided with a criss-cross corrugation forming a checked surface for giving a good grip under the bottom of the planer bed. The other flat which bears against the side of the bed is left smooth to avoid marring the painted surface.

How Beds Are Lifted

For picking up planer beds to place them upon the planer, remove them and carry them to the erecting floor, the simple method seen in Fig. 4 is adopted. The connecting medium between the casting and crane hook in this instance is an oak block, usually six inches wide by four deep, with a 1¼-inch wrought-iron loop passing down through the block with threaded ends on which are placed large washers and nuts, as indicated in the sketch, Fig. 5.

The block is rounded off at the ends to conform approximately to the internal fillet under the V's and is easily slipped into position crosswise of the bed. A collar on one side of the yoke keeps the latter from slipping down through the wood block when not in service.

The bed in Fig. 4 is 20 feet in length and weighs about 8500 pounds; yet this long, heavy casting can be picked up in

Fig. 1. Lifting a 30x30-inch by 10-foot Planer

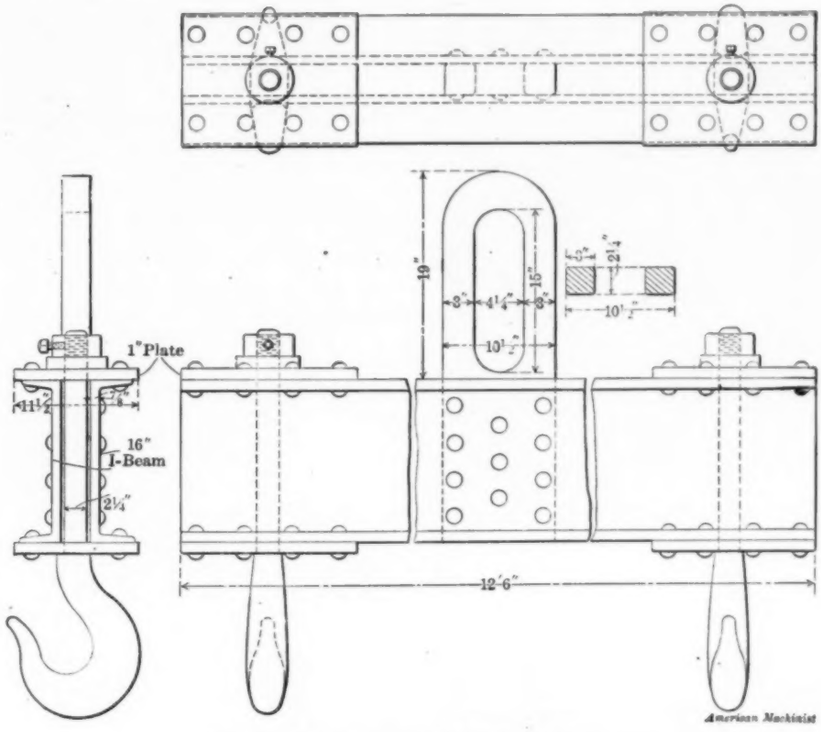


FIG. 2. BALANCER FOR LIFTING PLANERS

link. One of these handy appliances is shown on the floor under the platen, and some detail dimensions are included in the engraving, Fig. 7. The forging is amply heavy to take care of the load to which it is subjected, and the base which contacts with the work during the lift, is of sufficient length to prevent possibility of shearing of the cast iron along the T-slot sides. The T-shaped base is planed down to provide a smooth surface and the device is brought into use as readily as a T-head bolt could be slipped into a slot.

The advantages of this method of picking up platens as compared with sling-

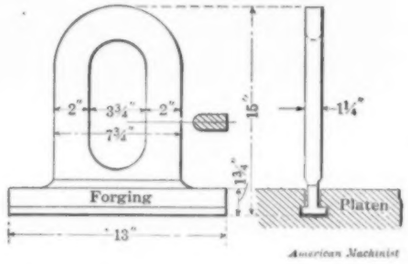


FIG. 7. DEVICE FOR LIFTING PLANER PLATEN

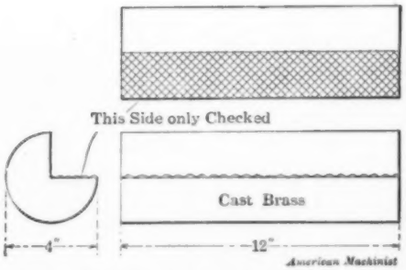


FIG. 3. SHOE USED BETWEEN CABLE AND BED

a moment with no fussing with rope slings of any kind, by the simple application of the oak block, constant use of which indicates to the man on the floor just what position the block should be placed in to balance the load.

HANDLING PLATENS

Fig. 6 shows how planer platens are handled by the application of a T-slot

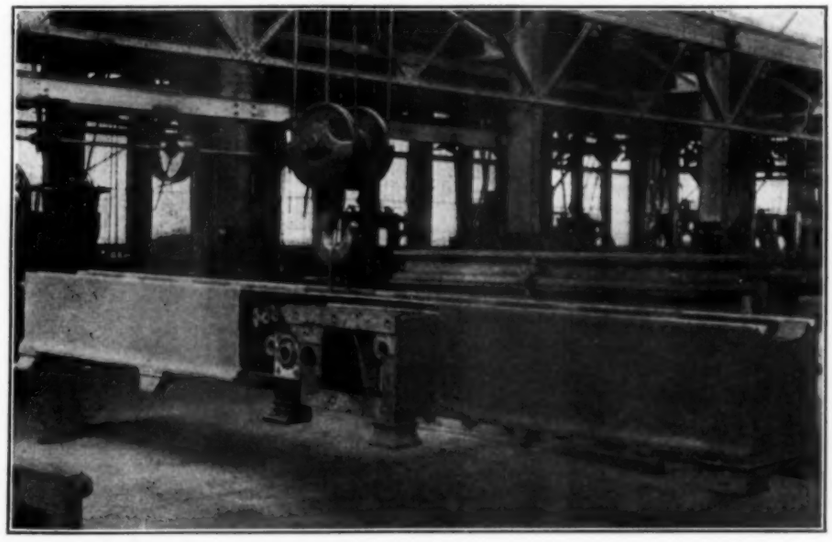


FIG. 4. LIFTING A PLANER BED

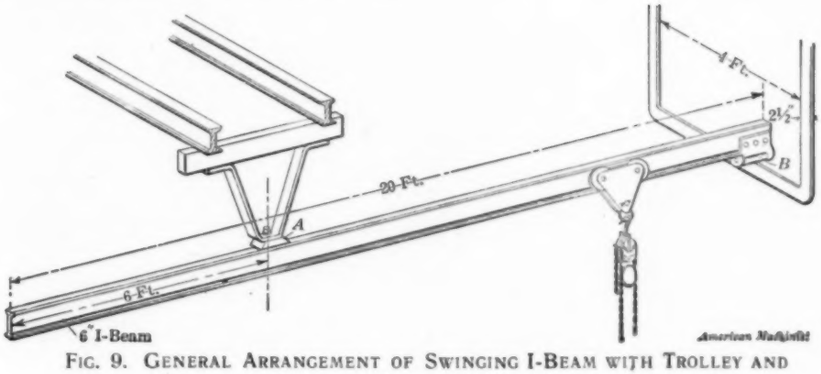


FIG. 9. GENERAL ARRANGEMENT OF SWINGING I-BEAM WITH TROLLEY AND HOIST

ing them by the end trunnions will be appreciated by anybody conversant with machine-shop practice.

A SWINGING TROLLEY RAIL

The overhead arrangement illustrated in Fig. 8, is one of a number of pivoted I-beams carrying trolley and chain hoists for facilitating the operation of handling lathe, grinder and turret-machine work. The appliance in the halftone serves the large Landis grinder and the 4¼ Gridley automatic turret machines, one of which is clearly seen in the immediate foreground. For handling heavy shafts in and out

FIG. 6. CARRYING A FINISHED PLATEN

of the grinder, and bar stock for the turret machine the arrangement is found a great convenience and a time and labor saver.

The 6-inch I-beam is about 20 feet long and is pivoted at *A* under a bracket suspended from the hanger supports, the outer end of the beam carrying a bracket with a roller *B* that rests upon a U-shaped support which permits the end of the beam to swing through an arc of about four feet, as shown by the diagram, Fig. 9. This swinging movement in the horizontal plane provides sufficient lateral travel for the work which has to be placed in the grinding machine, or for bar material that is to be slipped into the turret machine.

The rear end of the beam extends over another turret machine, a portion of which is seen at the extreme left-hand side of the view, Fig. 8.

Another of these swinging I-beam and trolley arrangements will be noticed over the rows of lathes further up the shop. The hoist is used wherever work of any size is to be placed in a machine that cannot be served with the regular cranes.

The ease with which the various heavy parts are handled in this shop with the special facilities described, is a feature very readily noticed by the visitor and one worthy of more general use.

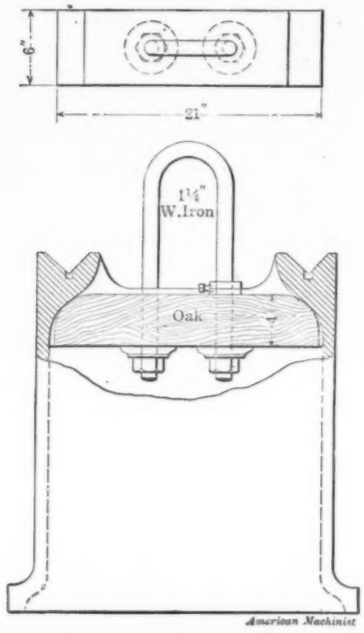


FIG. 5. BLOCK FOR LIFTING PLANER BED

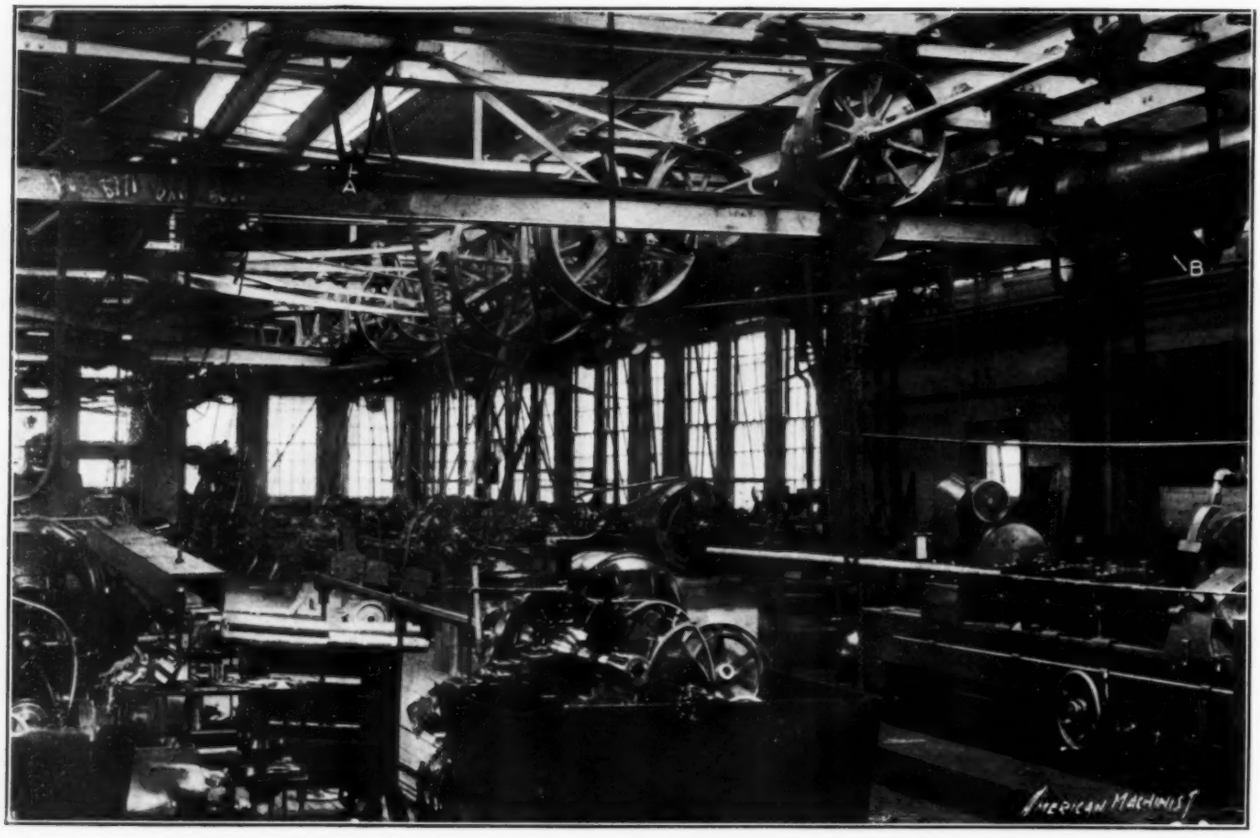


FIG. 8. A SWINGING TROLLEY BEAM

Pointers for Designers of Cranes

By J. Taylor

Proportions of details and points to be observed in the design of traveling cranes, especially of the overhead three-motor type. The structural work, the motor power required, loads on bearings and stresses in members.

The following notes deal with details of the design of traveling cranes and should be useful to those in that line of work.

Use rolled-steel joists for girders on cranes of light loads, up to 30 feet span.

Use built-up sections of box type for heavy cranes, single-web and auxiliary girders for cranes for light work.

Make depth of girders about 1/12 of the span in the center, for fish-bellied type.

Allow ¼ inch from edge of flange plates in girders to edge of angles.

Always put bolts in the tie plates for end carriages at each end, so as to make it convenient for taking out the runner wheels.

Put a tie channel across the ends of the girders, so as to connect them together firmly.

Use large gusset plates between the girders and top of end carriages, so as to make a good, strong connection.

Put stiffeners of channel section, or rolled-steel joists, between the web plates of the girders for securing the longitudinal motor.

Allow 10 per cent. more for rivet area than the net sectional area of the plate.

Allow 9000 pounds per square inch in shear for rivets.

Allow 7000 pounds per square inch in shear for turned bolts.

Make the diameter of the crane drum 20 times the diameter of the rope.

Make the diameter of the rope sheaves 20 times the diameter of the rope.

Never allow a factor of safety of less than 7 for the rope.

Always use rope anchorages of such design as will not necessitate ordering the rope with special ends.

Allow 2 more wraps of rope at each end of the barrel than what is required for the correct hight of lift, as by so doing you take all the pull off the rope fastening.

Make the pitch of the grooves on the crane drum about ⅛ inch more than the diameter of the rope, so as to prevent the ropes rubbing against one another.

Make the radius of the grooves of rope sheaves larger than the radius of the rope, so as to prevent wearing the rope.

Use rolled-steel sections for end carriages, up to 30 tons capacity, and built-up sections above this load.

Make the wheel base of the crane about ⅕ of the span.

Don't forget to put good, solid rail stops on the girders; otherwise there may be trouble.

Make the thickness of the metal under the grooves of the crane drum about 1.12 times the diameter of the rope.

Use a large number of ropes for lifting the load, as by so doing you lighten the trolley gearing considerably and put the greater portion of the load on the suspension girder.

Allow about 66 per cent. efficiency for hoisting motors.

Allow 55 to 60 pounds per ton for tractive force for cross traverse and long-travel motors.

Use cap bearings whenever possible, so as to make it easy in case of repairs.

Put lubricators in such a position that they are easily accessible for refilling.

Have all motors of the totally inclosed type and ½ hour rated.

Always place the long-travel motor in the center of the span of the crane.

Ratio of diameter of runners to runner axles for long travel to be 4 or 5 to 1.

Keep bosses on all long-travel runner wheels equal on each side, if they revolve on fixed shafts, and bush them with gun metal.

Proportions of runners for trolley:

$$\left(\frac{\text{Diameter in inches} \times \text{width of tread}}{4.5 \times \text{load in tons on each runner}} = 1\right).$$

Proportions of runners for long travel:

$$\left(\frac{\text{Diameter in inches} \times \text{width of tread}}{3.3 \times \text{load in tons on each runner}} = 1\right).$$

Always put overwinding gear for the hoisting motion and thus prevent a smash up.

Key the solenoid brake pulley to the motor pinion, and then key the whole together on the motor spindle.

Never stress shafts to more than 13,500 pounds per square inch.

The load on the teeth for the motor pinion should be figured from the horsepower of the motor, and the load on the barrel-wheel teeth from the load on the barrel.

The load on the brake rim should be figured from the motor, and not from the load on the barrel.

Put a good solenoid brake on the motor spindle that is capable of taking care of the load in case anything happens to the motor.

Always provide a mechanical load brake of the screw type, or washer type, in case anything should go wrong with the solenoid brake, and thus prevent the load from going down with a crash.

Make provision for well supplying the mechanical brake with oil, otherwise you will have trouble through its getting hot; also make good joints so as to keep the oil in, by packing these with leather rings.

Arrange the pawls for the mechanical brake so as to be automatically lifted out when the brake is running free; otherwise it will be noisy.

Use wood blocks or leather strips for braking surface on the solenoid brake.

Always use a dead weight for the brake, and not a spring, as the latter is liable to lose its tension in time.

Connect the solenoid to the brake lever by a couple of side links, so as to get a straight movement of the plunger.

Make the length of the bearings at least 1½ times the diameter of the shafts.

Make the top and bottom brasses of the bearings exactly alike so that they may change places when wear occurs.

You can go up to 800 pounds pressure per square inch of projected area for bearings, and to about 1200 pounds for pins and shafts of block sheaves.

Always use machine-cut gear wheels; make the wheels of cast steel and pinions of mild steel.

Make the pinions ¼ inch wider on the face than the wheels.

Put lock nuts on all bearings so as to prevent them shaking loose.

Use fitted bolts for holding down the pedestals.

Bolt the barrel spur wheel to the barrel with fitted bolts instead of fitting keys.

All surfaces to receive bearings or brackets should be planed.

All pinions running loose on shafts to be bushed with gun metal.

If a motor extension shaft is used, be sure to have the end running in a high-speed, self-lubricating bearing.

When cranes for heavy loads have to deal with light loads also, put a change gear in to lift the light loads quicker.

Design the trolley so as to get more load on the cross traverse driving wheels, so that the wheels do not slip on starting to traverse; if not, you will require a sand pipe.

Arrange the trolley so as to have the motors on the platform side.

When a change gear is employed, be sure to provide a brake to prevent the block running down while changing the clutch.

Make the length of keyways 2¼ times the distance through the wheel or pinion hub.

Arrange the position of the cage so that the crane driver can see exactly what he is doing with the load.

Arrange a foot brake on the longitudinal gear, to be worked from the cage, so as to stop the crane quickly.

Don't put the treadle for the foot brake where the operator cannot get his foot on it easily.

Keep the couplings for the long shaft as close as possible to a bearing.

If tramway-type controllers are used, be sure to leave enough room in the cage to put them and also the necessary resistances; but if liquid type of controllers are used, then you require no resistances.

Use ¾-inch gas piping for hand rails.

Have platform boards 2 inches thick by 6 inches wide.

Carry the cross leads on the inside of the girders; if several leads are required divide them and run them equally down each side.

Don't use fiber for insulation, as this sometimes causes trouble.

Put insulator brackets with porcelain insulators every 30 feet.

Use slipper collectors for cross leads and pulley type for main leads.

Allow 1500 amperes per square inch for copper leads, 1000 for gun metal and 1/6 of copper, or 250, for steel.

Allow 150 amperes per square inch (not more) for copper contact and 50 per cent. more for brass.

Allow 800 amperes per square inch for copper for current resistance; ½-inch break for 110-volt switches; ¼ inch extra for next 100 volts, and 3/16 inch more for next 100 volts.

Allow 135 pounds per ton for tractive force for traveling motors for trolley hoists.

When worm gear is used, always put a ball bearing to take the thrust.

Allow 2¼ to 2¾ tons per square inch for shanks for crane hooks.

Don't stress cast iron to more than 2200 pounds per square inch for crane work.

Use steel-plate sides for all snatch blocks above 30 tons load.

Make diameter of chain barrels 24 to 30 times the diameter of the chain.

$$Electrical\ horsepower = \frac{Amperes \times volts}{746}.$$

Remember that one man cannot exert more than ⅛ horsepower in hoisting a load by a rope over a pulley.

Allow 200 feet per minute for peripheral speed of rope for hand cranes for hoisting, traversing and traveling.

One man can hoist one ton about 24 inches per minute, and other loads in proportion, by hand.

The minimum distance between the center of a rivet and the edge of a plate should not be less than 1½ times the diameter of the rivet.

All ton units are of 2000 pounds each.

Two Special Slide Rules

By G. S. Hawkins *

Two special slide rules to determine the cost of machines and their applications to shop work. The rules are accurately printed full size and may be traced and used.

*361 North Grove street, East Orange, N. J.

The special (for want of a better name) slide rule, that is, an instrument which is designed to perform one certain line of computations, is a novelty to many, and may be found of interest to those whose duties necessitate their making many calculations of the same kind. Some of the slide rule experts will say, this form of rule is of no advantage, because the results are easily found on a standard slide rule. This is quite true, but it must be remembered that we are not all experts in using this instrument, which requires considerable study and practice to operate with confidence, while the special may be correctly used by anyone after a few minutes' inspection.

Although the slide rule has been known for many years, its value was not generally recognized until recently. Now it is used by most engineers and others who have become acquainted with its usefulness. One of the reasons for its not being in more general use is that some time and patience are required to operate it successfully; many who start with the intention of mastering it, give up in a little while, becoming discouraged on account of repeated doubtful readings. They may have arrived at the correct results, but are not sure, then the problem must be figured the old way, which, of course, with the rule, takes double the time, so the slide rule is finally thrown aside, while a little more perseverance might have given the necessary confidence.

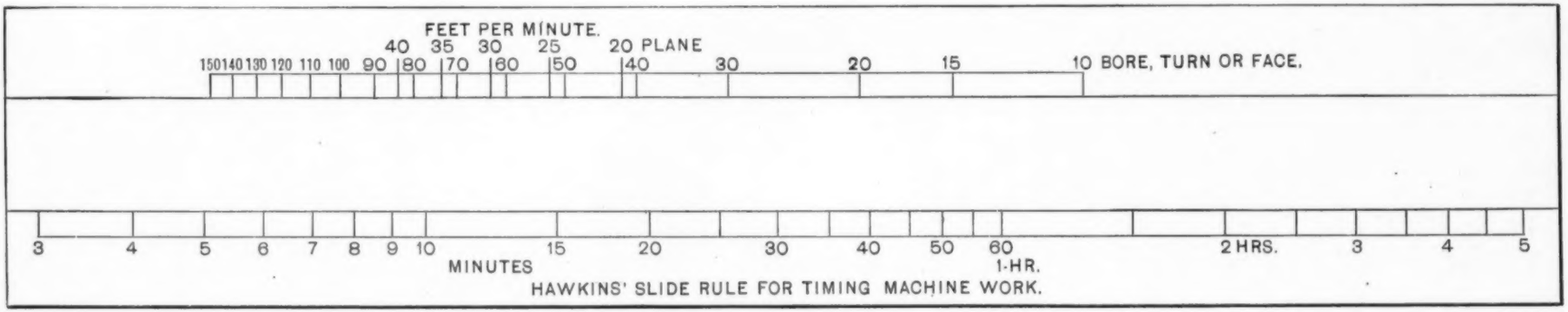
To be successful one must use his memory to a certain extent, because most problems are solved by the use of constants and further the correct using of formulas as regards the reading of results from the right scale; then comes the correct placing of the decimal point, which is probably the most troublesome of all, unless the operator has been properly instructed on this feature. All these troubles are eliminated in the special rule, study and practice not being necessary—the constant is absorbed in the relative position of the scales to each other—there is no danger of reading results from the wrong scale and the values are definitely determined without mental effort because the position of the decimal point has been established in numbering the graduations.

With the comparisons made above the reader can appreciate the value of special rules, especially to those who are not familiar with the regulation rule, and are called upon to make numerous calculations of the same nature. It is possible to make these rules for solving almost any problem and their operation is always simple and easily understood. The two rules shown on the opposite page are selected because they may be of particular interest to many readers of this magazine. The rule for boring, facing and planing being used for determining the time required for a cutting tool to move from one point to another at a given speed and feed, the setting of the work, etc., to be added, the other giving time required for turning and threading shafts and includes setting of work, etc.

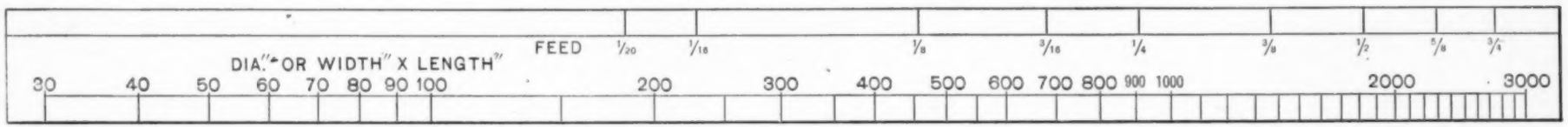
Slide Rule for Turning Machine Work

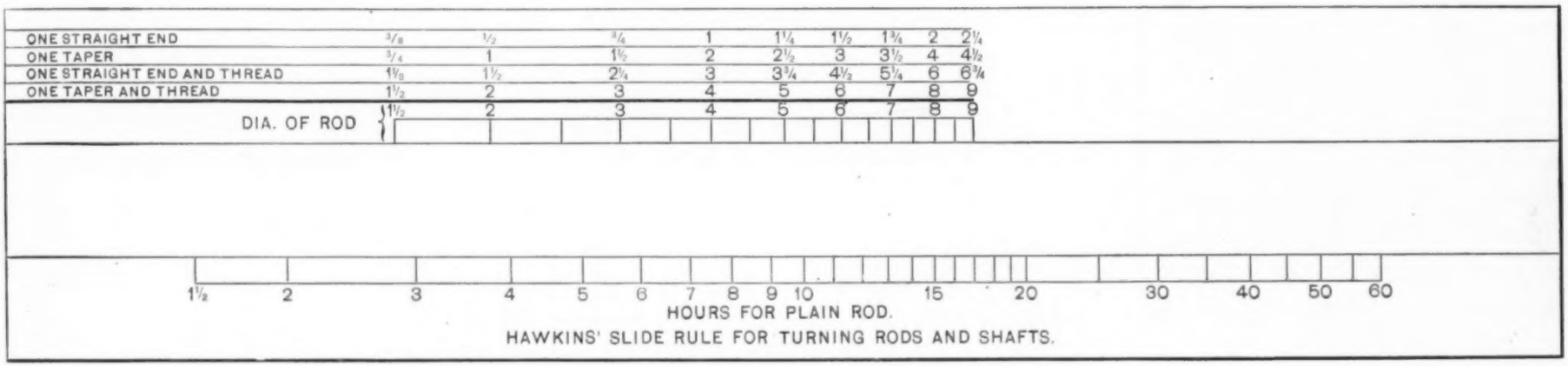
The first-named rule is described as follows: The upper long scale shows the feet per minute travel of lathe tool, the short scale above it shows the same thing for planer tool, allowing for reversing; upper scale of slide it will be seen gives the feeds; lower scale of slide is for the dimensions, the graduations representing the diameter of work multiplied by its length both in inches, or the width of a face multiplied by its length or diameter; also in inches—lower scales give us the actual time of tool in passing over the entire surface.

To illustrate; suppose we take a simple problem. A cast-iron cylinder 12 inches diameter and 40 inches long is to be turned its full length, two cuts being taken, the iron is known to be rather hard, so in this case 32 feet per minute is considered a satisfactory speed with a feed of ⅛ inch for the roughing cut. This having been decided the slide is now moved until 32 feet speed on upper scale coincides with ⅛-inch feed on upper edge of slide; then 12 inches × 40 inches = 480, find 480 on lower edge of slide and under it see 25 minutes, the time for roughing cut. The second cut to be figured at ¼-inch feed. This, of course, being one-half the time of roughing cut or 13 minutes—to the time already found we must now add for getting ready, setting and removing piece from lathe; this time is estimated say 45 min-

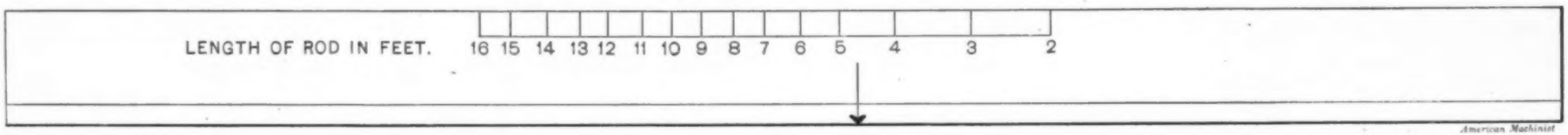


HAWKINS' SLIDE RULE FOR TIMING MACHINE WORK.





HAWKINS' SLIDE RULE FOR TURNING RODS AND SHAFTS.



American Machinist

utes; thus making our time so far 83 minutes.

Now experience has shown that approximately 20 per cent. of the average workman's time is used in other ways than actually performing work, so this must be taken into account and then we must add a profit for the workman, of say, 20 per cent. Therefore we now have 83 minutes plus 40 per cent. = 2 hours as the time which the workman receives.

This same rule applies to boring also, taking into account the kind of boring bar employed.

Let us now consider a facing operation: A flange 50 inches outside diameter and 40 inches inside diameter is to be faced, two cuts, same speed and feed, as previous example. Set ⅛-inch feed to 32 feet speed; the average diameter is 45 inches, this multiplied by 5 inches face equals 225; under 225 find time for first cut, 12 minutes; second cut ¼-inch feed equals one-half the time or 6 minutes. To this add for getting ready, chucking and removing, say 45 minutes to the total (63 minutes) add 40 per cent., making about 1½ hours as the price.

Planing is found in precisely the same way. Suppose we want to plane a face 30 inches by 70 inches, speed 30 feet, feed 1/16 inch—set 30 feet to match 1/16-inch feed, $30 \times 70 = 2100$. Under 2100 find the time 1.8 hours, or 108 minutes. Finish cut figured as ¼-inch feed gives one-quarter this time or 27 minutes, setting, etc., 90 minutes equals 225 minutes total; adding 40 per cent equals 5¼ hours for price.

It will, of course, be understood that in the illustrations given special tools have not been taken into account, the ordinary lathe and planer being used.

Perhaps it is hardly necessary to mention the fact that in order to get good work from this or any other method, competency and judgment are the first requisites to satisfactory results.

Let us look over the situation now that the reader is somewhat acquainted with the methods and judge the value of what we have. We determine for ourselves, the speed and feed at which the work must be turned out in order that the workman may make a profit. Any man with shop experience knows that a portion of the average man's time is lost in various ways, and we are not far wrong when we assume it to be 20 per cent.—the profit to be added has been definitely settled upon; it may be 20 per cent. more or less. So the only chance of error is in the estimate for setting, etc.; even though we are somewhat off in this the price is not seriously impaired. Therefore we have in this method a sound basis from which values can be established with the knowledge that they are practically correct.

This system is particularly adapted to large work, or to cases when the actual tool time is a very considerable portion of the estimated time. On small work the tool time is so small, compared with other necessary operations, that too much is left to be estimated, and for this reason is not recommended for small work in general.

Slide Rule for Turning Rods and Shafts

The rule for turning rods and shafts will now be easily understood without much explanation. Owing to the setting time, etc., being small and practically the same on all rods, this is included right in the time, together with the profit, so that no additions are necessary to the result on this account.

Note the table on upper part of rule marked "one straight end," "one taper," etc. This term "straight end" means one end of the rod turned straight for a short distance and made a smaller diameter than the main body of the rod; the other terms will be clear without explaining.

If a 4-inch rod is to have a taper turned on one end, two hours is to be added to the time for a plain rod. This two hours is shown over the diameter of rod, on the same line as "one taper." One straight end and thread on a 3-inch rod will have 2¼ hours added, etc.

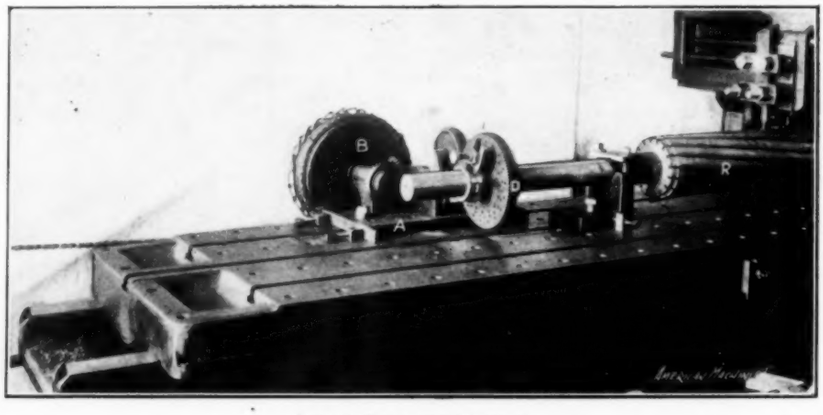
Suppose we have a piston rod to be turned and well finished; one end is to have a taper, the other straight and threaded, size of rod 4 inches diameter 7 feet long. The rule is set so that diameter of rod matches the length, then the arrow on lower edge of slide is pointing to the number of hours allowed for a plain rod; adding two hours for taper and three hours for straight end and thread makes 15 hours, as the total price for rod, including the profit. This time is for the rod made on an ordinary lathe, without special tools or rigging.

Either of the rules as printed here can be put to practical use, just trace the rule and slide to the outside lines (two pieces to each complete rule), lay the slide between graduations of rule and they are ready for use. If desired more serviceable, paste them on thin wood or press board strips, and give a coat or two of thin, white shellac, mounted in this way the rule can be cleaned and will last a long time with ordinary care.

A Convenient Spiral Planing Device

There are many different methods of cutting spiral slots on a planer and the one illustrated herewith has been in use many years in the shops of Curtis & Marble, Worcester, Mass.

As will be seen the roll *R* to be planed is mounted in the blocks and held by straps just so that it can be turned easily by the gearing shown. The casting *A* is bolted to the planer table and carries the drum *B* which turns the work to be planed, through the bevel and spur gearing shown. The drum is revolved by a chain wrapping around its periphery, one end of the chain being fastened to a support at the end of the planer, the drum being returned to its original position by a chain running to the opposite end and being hidden by the planer table.



Spiral Planing Device

It will readily be seen that as the planer table moves under the cross rail the drum is revolved by the chain at the left and the work is turned according to the number of teeth in the spur gears. These gears can be changed so as to secure any reasonable degree of angle of spiral which makes this device more universal than is generally the case. It will also be noted that the gear *D*, on the shaft carrying the work, has a number of index holes and that an index pin is so located that the work can be turned any part of a revolution so as to have the desired number of slots located in their correct position around the periphery. There are probably many places where a similar device could be used to advantage.

When sulphuric acid is left exposed to the air, it absorbs water and becomes weaker, so it should always be kept in a tight carboy or other closed receptacle.

Tools in Computing Scale Plant

By F. A. Stanley

Some good miller attachments for cutting fine-pitch teeth in brass pinion and rack blanks; one of these with an adjustable feature which enables two blanks to be cut simultaneously on separate arbors to an exactly uniform depth.

A magnetic fixture for the profiler which holds an odd-shaped piece in place while the upper edge is faced true. Method of milling both ends of a column at one setting with large inserted-tooth cutters.

Drill jigs of various types in several of which indexing devices are incorporated to facilitate the drilling of holes about the periphery of the work.

The articles already published in these columns upon the plant of the Computing Scale Company, of Dayton, Ohio, have shown many of the tools and methods adopted by this concern for facilitating the manufacture of its product. Some further devices and processes used in this establishment are illustrated by the accompanying engravings.

A Duplex Pinion Cutting Fixture

An important member of the computing scales manufactured by the plant referred to, is a brass pinion which is formed on the end of a flanged sleeve about 1½ inches long, and which has a diameter of perhaps ⅝ inch. Several of these pinions are shown on the tray on the end of the milling-machine table in Fig. 1, and two of them are in place in the fixture, under the cutters on the arbor.

These pinions have to be cut accurately, and as they are made in large numbers, it is a decided advantage to have a double fixture which enables two to be cut simultaneously. At the same time, with a double fixture, it is essential that suitable means be incorporated in the device to permit of independent vertical adjustment of one of the blanks so that uniform depth of tooth may be assured in both pinions. How this feature is secured will be seen upon examination of Fig. 1.

Construction of the Fixture

The fixture base is composed of three important members; the base proper, *A*, the adjustable block B, and the adjusting wedge *C*. The base itself is cut down in front and provided with a sloping face for the reception of wedge *C*, which has a very easy taper, and which, when adjusted endwise by the screw at *D*, adjusts block *B* vertically. The latter block is formed with a vertical guide surface at the rear which fits a corresponding surface planed in the front side of main block *A*, the joint at one end being plainly shown in the engraving. There are also three clamp screws passing through the front block *B* into the main casting *A*, so that the adjustable block is not only guided properly against the vertical face of the main block, but is also secured squarely and rigidly in place after adjustment.

The adjusting wedge is provided with a graduated plate at E, and the finished pad on the face of the block *B* carries a zero line to which the scale graduations are brought in making adjustments. The taper of shoe *C* is such that about 1/16 inch longitudinal movement gives a vertical adjustment of one-thousandth of an inch to block *B*. This makes it possible to adjust the front block and the work it carries, very accurately, to compensate for differences in the two cutter diameters, due to irregularities in sharpening or to other sources.

The Indexing Mechanism

The brass pinions cut in this fixture have a 5/16 hole through the body and they are held on a special form of arbor which is drawn into the spindle of the fixture. The outer ends are supported in the manner indicated in the illustration.

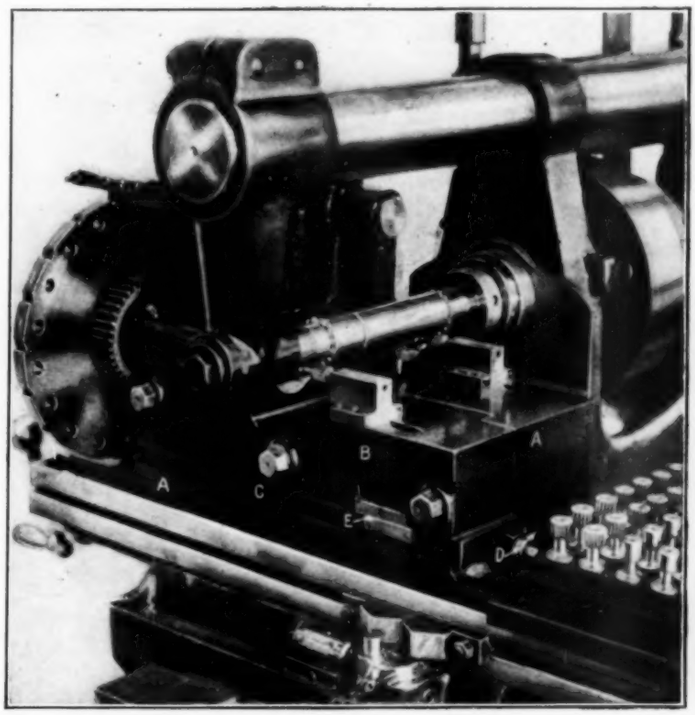


Fig. 1. Duplex Fixture for Cutting Small Pinion Teeth on the Miller

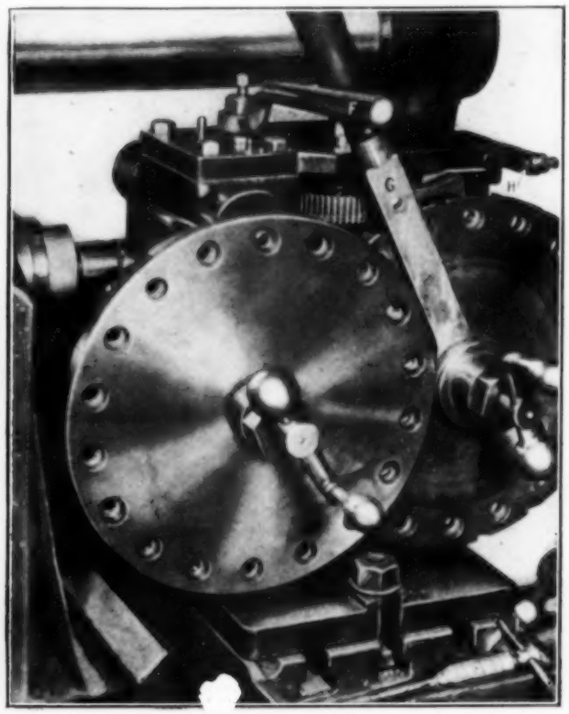


Fig. 2

The spindles are provided at the rear ends with index plates which are fitted with hardened and ground bushings for the locking pins. The ends of the two pins will be noticed in the end view, Fig. 2 These index pins are fitted in the ends of two long steel plungers which are provided with rack teeth on one side, and two pinions which engage with the racks are connected by a spur gear which is also plainly visible in the end view. The handle at *F* is attached to the upper end of the stud carrying one of the pinions, and when this handle is moved to the left both index pins are withdrawn from the dials, against the pressure of a pair of compression springs that force the index pins forward when the handle is released.

How the Dials are Actuated

With the index pins withdrawn, the longer lever *G* is drawn to the right to rotate the dials to the next station, this being accomplished through the medium of a pawl on the lever which engages with ratchet teeth on the periphery of the right-hand dial, a pair of spur gears connecting the two spindles so that any movement of this dial and its spindle produces a corresponding movement upon the part of the other spindle and dial.

Lever *G* swings between a stop at *H* and the edge of the dial to the left, and its forward stroke is regulated by the stop screw to bring the dial holes opposite the index pins.

The teeth are cut by feeding under the cutters and back again, giving smooth and accurate results. The work is placed in convenient trays that provide a means of carrying the pinions through the various operations required, without danger of injuring them in the handling.

Another Gear Cutting Attachment

Fig. 3 illustrates a fixture for milling the teeth in another type of blank, which is cut only part way around. A single spindle is used, but two blanks are cut at once on the same arbor. As in the other case described, the blanks are of brass and their diameter is about ⅞ inch.

A large index wheel, many times the diameter of the work, is used and the spacing of the teeth is accomplished with accuracy. The dial has several groups of index holes, either complete circles or extended over a sufficient length of arc to cover the requirements of the work for which they are included in the dial.

The index pin is carried in a sleeve which is adjustably mounted in the slotted vertical arm of the head casting which extends upward far enough to provide for the indexing of dials considerably larger than the one represented in place on the fixture. As in the case of the sleeve pinions shown in Fig. 1, the work is passed once under the cutter and then back.

A Rack Cutting Operation

Still another operation in the tooth-cutting line is represented in Fig. 4. This view shows a milling machine equipped for cutting 32-pitch rack teeth. The indexing of the table for the different teeth is accomplished by a simple arrangement attached to the front of the knee. This device consists of a bracket, to which is attached a stud for a gear that engages with another gear upon the end of the cross-feed screw. The gear on the stud has a handle in its outer face for convenience of operation, and a pin is secured in its inner face at *I*, for the indexing of the mechanism. This pin is in line with, and supports the outer end of a pivoted lever *J*, which has a notch in its lower edge that allows the lever to engage the pin and lock the gear at a fixed point in its rotation.

After each cut, the lever is lifted, the gear turned to feed the table and rack to the next position for the following tooth cut, and the gear again locked by the notch in the lever engaging the pin *I*.

The formed cutter for the rack teeth is not shown very clearly in the photograph, owing to the fact that a plain milling cutter is used beside it upon the arbor, for

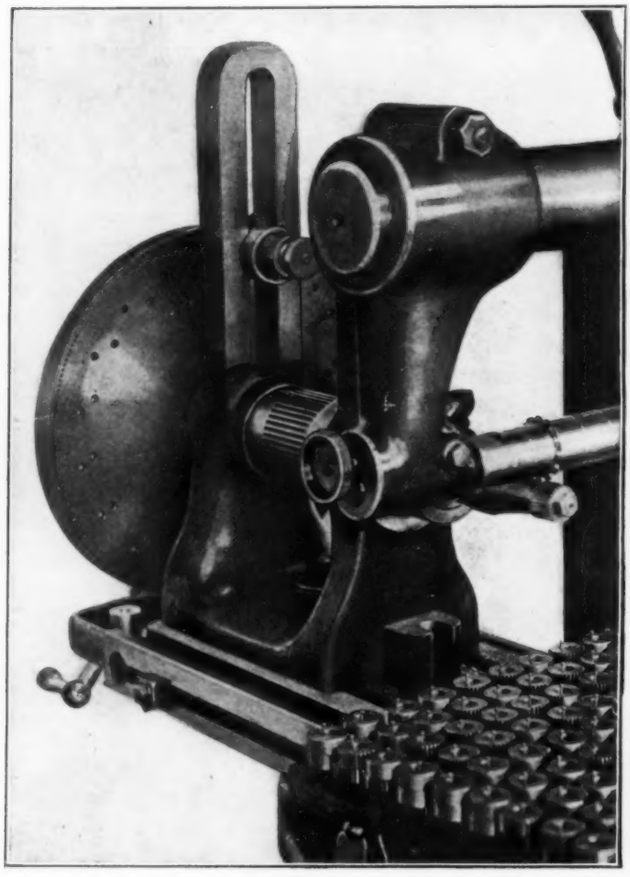


Fig. 3. Milling Teeth in Small Brass Gears

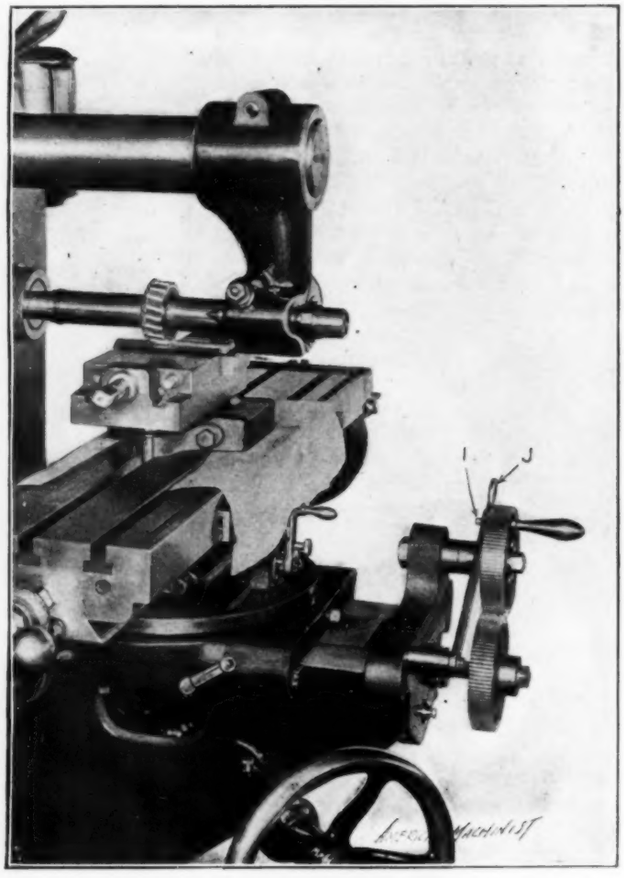


Fig. 4. Milling Rack Teeth

dressing off the top of the rack blank in advance of the milling of the teeth. This cutter is ground to a certain diameter in relation to the rack tooth cutter, and in passing over the surface of the work it provides a true, smooth face and assures a correct depth of tooth.

Magnetic Fixture for the Profiler

Two views are presented in Figs. 5 and 6 of the magnetic fixture for holding work on the profiler. The piece to be machined in this fixture is shown at *K* and is a portion of the case for an insurance scale. It is necessary to profile the edge all the way round to provide a straight surface for the joint which is formed with other members of the case.

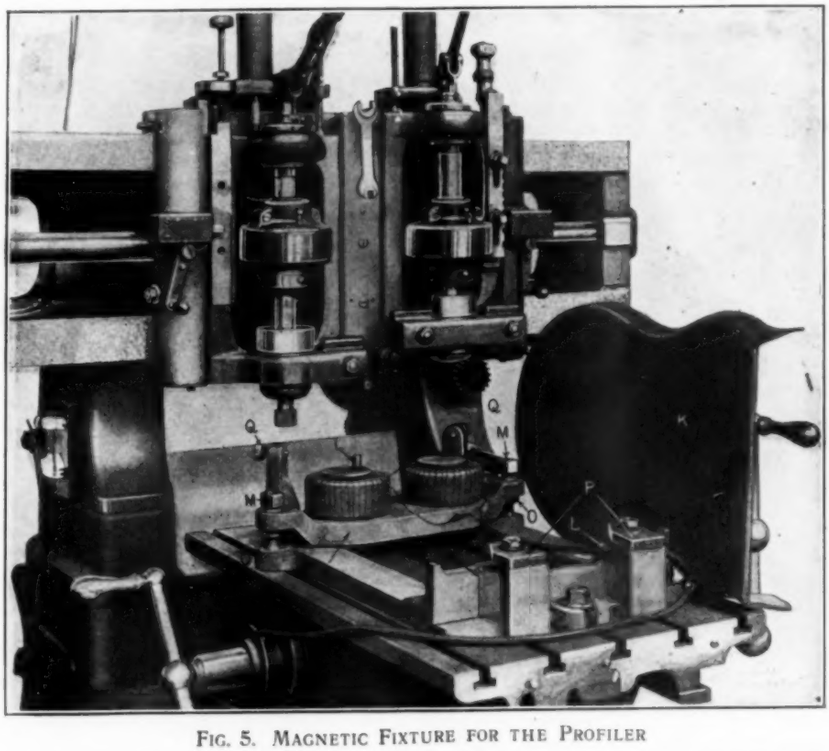


Fig. 5. Magnetic Fixture for the Profiler

The piece to be profiled is placed upon three level bearing points *L L L*, in the fixture; then assuming that nuts *M M* have been loosened sufficiently to give block *N* with its coils the necessary amount of freedom, the current is turned on and the magnets jump into contact with the under side of the work, attaching themselves to the surface of the piece, and when nuts *M M* are tightened, the work is drawn down snugly on its three-point bearing. While secured in this manner, two nurled nuts *O O* are adjusted up under the block *N*, to prevent downward spring at this point when the cutter is at work, and two straps *P P* are tightened upon the front end of the work while the two nurled screws *Q Q* at the rear complete the fastening devices.

Strictly speaking, the two nurled-head screws just referred to are end-locating mediums, against which the work is placed when it is dropped upon its three resting spots. As they are easily adjusted, they may be set up as required to contact properly with the work. There are two lugs projecting above the bearing surfaces at the front so that the piece is centered sidewise when placed in the fixture. These locating projections are shown clearly in both Figs. 5 and 6.

Milling Both Ends of a Column

A double-end milling operation is illustrated by Fig. 7. This shows how a cast-iron column for the insurance scale is milled to correct hight at one setting. The double-head miller of the Lincoln pattern is fitted with a holding fixture for the casting and with two large inserted milling cutters for simultaneously facing both ends of the work.

The fixture is of simple construction, and its stops and clamps are seen clearly in the engraving. The cutters are of high-speed steel inserted in the heads at a considerable angle to give a free cutting action, and these blades are held by taper pins driven into holes slotted out to the edge of the cutter head.

Some Drilling Jigs

The jigs in Fig. 8 are typical of a number of drilling devices used for handling light, slender parts, the work seen in place in this view being check steelyards for certain types of scales. The holes to be drilled in such parts are quite small and the jigs are therefore made light in weight to enable them to be manipulated easily under the drill spindles.

The illustration shows one of the large tables that are commonly used in the plant for holding work under the spindles where the piece has to be moved about in all directions and where ample table area is quite important.

It will be noticed that the jigs are built up of base and uprights, inserted feet and attached bushing brackets and plates. The clamping of the work is accomplished in each case by means of small nurled-head screws, which hold the piece tightly enough to prevent its moving under the light drilling operations necessary, yet are not likely to spring it when set up with the fingers.

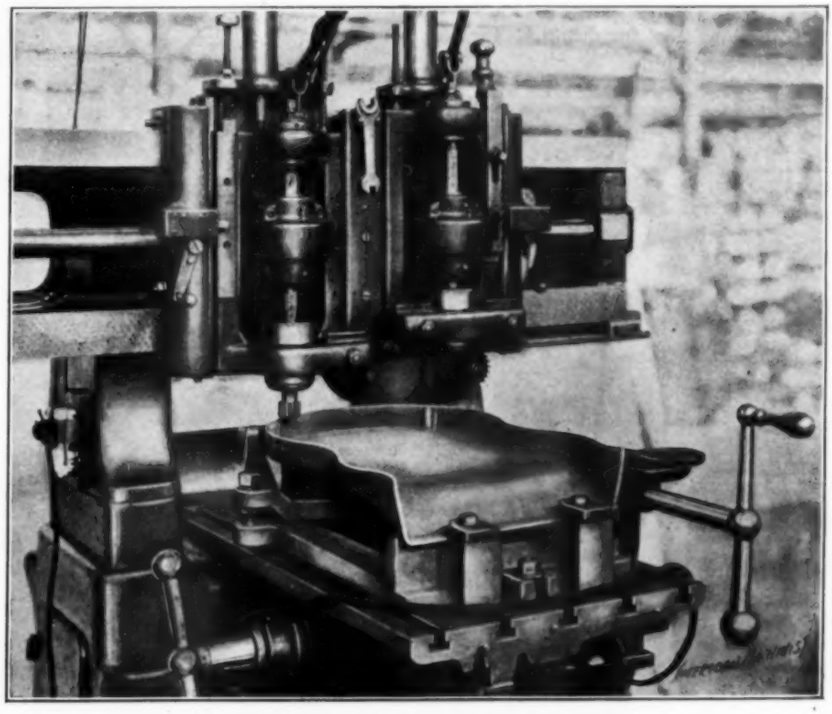


Fig. 6. Magnetic Fixture for the Profiler

An Indexing Drill Jig

The jig in Fig. 9 is for drilling heads for what is known as a drum-head type of scale and one of the castings is seen in position at *A*, in the indexing portion *B* of the jig. The latter is mounted upon a stud in the frame or base *C*, and is adapted to be indexed to various points in the circle for the drilling of the different holes through the periphery of the work.

The casting requiring drilling is located on a centering plug in the rotary portion of the jig, and is secured in place by thumb screws in the lid or door *D*, which is held to the head *B*, when closed, by two thumb operated buttons. After the holes have been drilled in the edge of the work by locating with the indexing member, the jig may be turned down on its side for putting the holes through the face and arms of the casting.

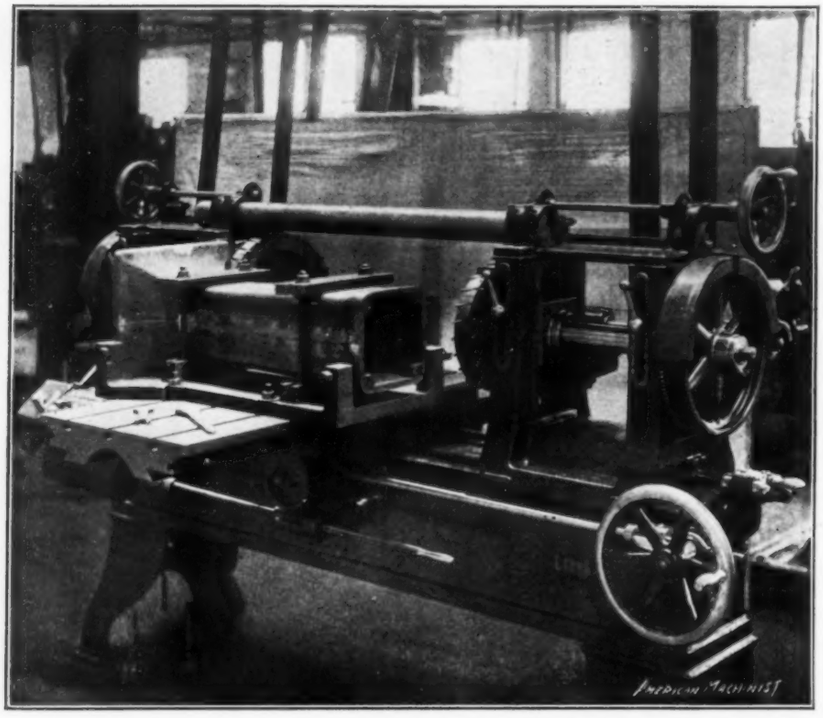


Fig. 7. Milling Top and Bottom of a Column

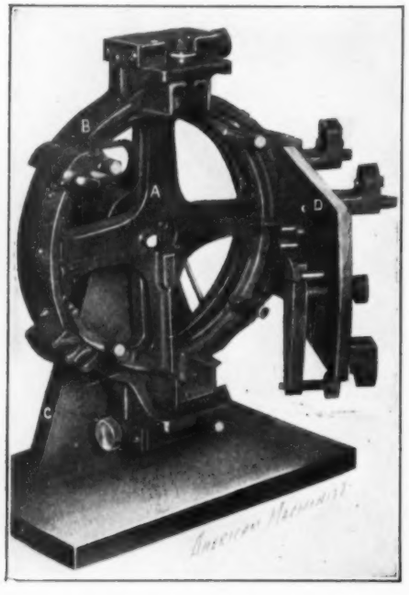


Fig. 9. An Indexing Drill Jig

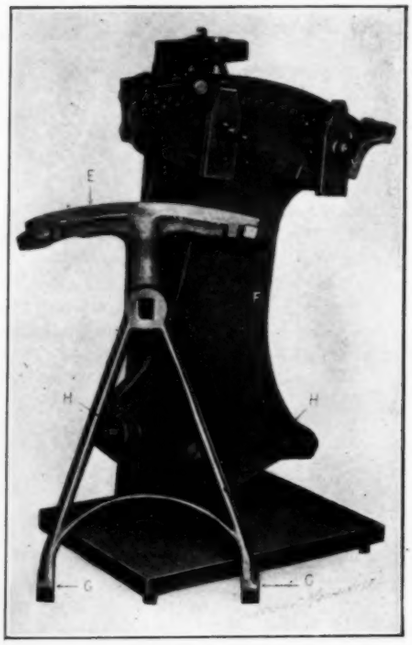


Fig. 10. Another Indexing Jig

Another Indexing Jig

While the principal product of the establishment is computing scales and other apparatus for weighing merchandise, several other classes of articles of an allied nature are also produced here, and one of these is a meat slicer for butcher shops and grocery stores. This machine

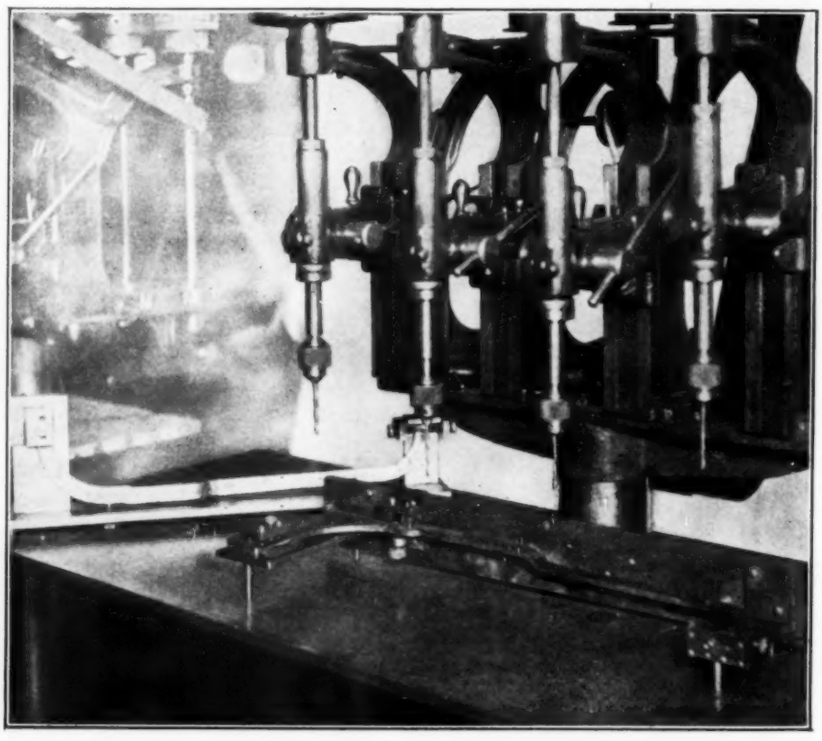


Fig. 8. Some Long, Slender Drill Jigs

has in its feed mechanism for carrying the material to be sliced past the rotary knife, a series of equally spaced pins located in the end *E* of the casting shown in Fig. 10, this row of pins serving as rack teeth.

The jig for drilling the holes on correct center distances is shown at *F*, and consists of the pivoted plate in front upon which the casting to be drilled is placed, and the fixed base and upright with the drill bushing and index pin at the upper end. Casting *E* is drilled at the ends of its forks in a pervious operation and the holes through these fork bosses at *G G* are used in connection with nurled-head screws *H H* for locating the work in this jig. The position sidewise is determined by the two swinging tops at the upper end of the plate *F*. The arc-shaped head of the casting is rested upon two hardened plugs at the top of the swiveling plate *F*, and the two straps directly over these bearing points secure the work in place.

Operation of the Device

The upper end of plate *F* is provided with a series of hardened, ground and lapped bushings to receive the index plunger which enters from the back and is controlled by a lever which acts against the pressure of a spring in withdrawing the plunger from the index bushings.

The guide bushing for the drill is fitted in the projecting portion of the upright, and the upper end of the swivel plate is adapted to slide under a retaining plate which acts as a gib in steadying the free end of the plate. With the work in place, one hole after another is quickly drilled and the intervening indexing operations accomplished in an instant, by simply pulling the plunger-controlling lever and swinging the work-carrying plate to the next position.

A Compact Blueprint Room

In a little room on the same floor as its offices, at 30 Church street, New York city, the American Bridge Company has one of the most compact blueprinting plants imaginable. The room itself is 11 feet, 7½ inches by 15 feet, 3½ inches, and 1250 prints of all sizes from 8½x15 to 24x36 inches can be turned out in eight hours, and the average steady run of the blueprinting machine is about 36 hours per week.

A partial view of the room is given in Fig. 1, the big, six-lamp Federal printing machine being shown on the right and the Richardson electric drying machine and tanks on the left. The drying machine is capable of drying a 24x36-inch blueprint in 20 seconds, though this time is lengthened where a number are run through owing to the cooling of the heating surfaces.

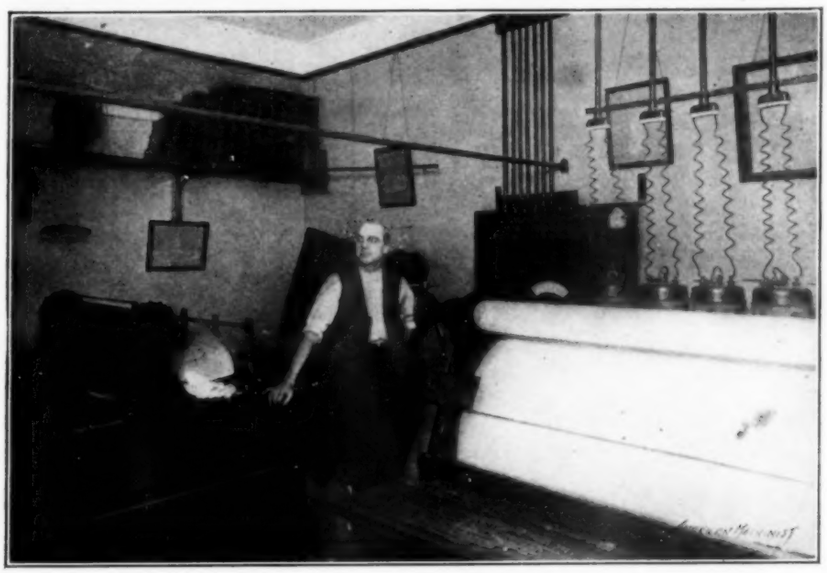


Fig. 1. Partial View of American Bridge Company's Blueprint Room

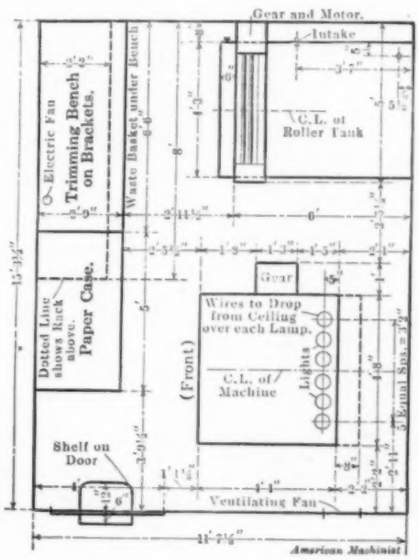


Fig. 2. Plan of Blueprint Room

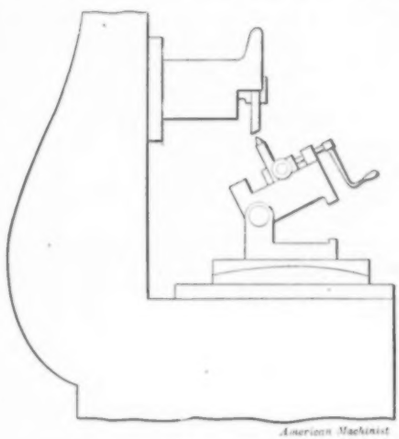
Fig. 2 is a plan view of the room, giving the location and sizes of all the fittings.

Dressing Surface Grinder Wheels

By G. E. Gay

It is sometimes necessary to dress surface-grinder wheels accurately to a given angle, to form angles on work, not accessible for grinding by the usual cross traverse. Any angle from parallel with the axis, to 90 degrees with the axis, can readily be dressed as shown, by tilting the swivel vise to the desired angle, and clamping the diamond holder to the sliding jaw, using the traverse of this jaw to form the angle.

The diamond holder is clamped by means of a screw, with a large flange, tapped into the sliding jaw as shown. It will be seen that the diamond point must be centered with the wheel, or in other words must operate on the wheel at its lowest extremity to produce a true angle; the vise is covered with a cloth when dressing to keep the dust from the working parts.



Dressing Surface-grinder Wheels

The composition of several alloys that will cast equal to die-casting metal, with practically no shrinkage and be fairly hard, are given as follows in a recent issue of *The Foundry*. An alloy that has a minimum shrinkage can be made by adding 5 pounds of bismuth and 5 pounds of antimony to 90 pounds of half-and-half solder. This alloy, however, is expensive. Other alloys having only normal shrinkage and less costly are: (1) Lead, 75 per cent.; antimony, 15 per cent.; and tin, 10 per cent. (2) Lead, 80 per cent.; antimony, 10 per cent.; and tin, 10 per cent. (3) Lead, 85 per cent.; antimony, 10 per cent; and tin, 5 per cent. Any of the alloys here given can, according to *The Foundry*, be used for die casting, and will cast with accuracy, providing the mold or die is accurate.

A Tool Room Index for Laying Off Angles

By C. A. Guion*

Devices for laying off angles in the tool room seem to be very much to the fore in the American Machinist just now, and this leads me to send two illustrations of a fixture which we have found so successful that four of them have been made for our model and tool-making departments.

A graduated circle *A* and a notched indexed plate *B* serve to obtain the required angle. The ring *A* is attached to the plate *B*, which latter is a fairly snug fit on the spindle. Attached to the spindle are the adjusting plate *C* and the face plate *D*, the latter having a series of holes for attaching the work to it. An index pointer *E* is fastened to the base, and a latch lever *F* carries a block for engaging the notches in the notched plate.

The spindle has a standard-sized hole through it, the center of which is exactly 7½ inches from the base. A hight gage with vernier attachment enables the work to be located initially exactly horizontal, and, if need be, exactly central with the plate.

*Foreman, model-making department, National Cash Register Company, Dayton, Ohio.

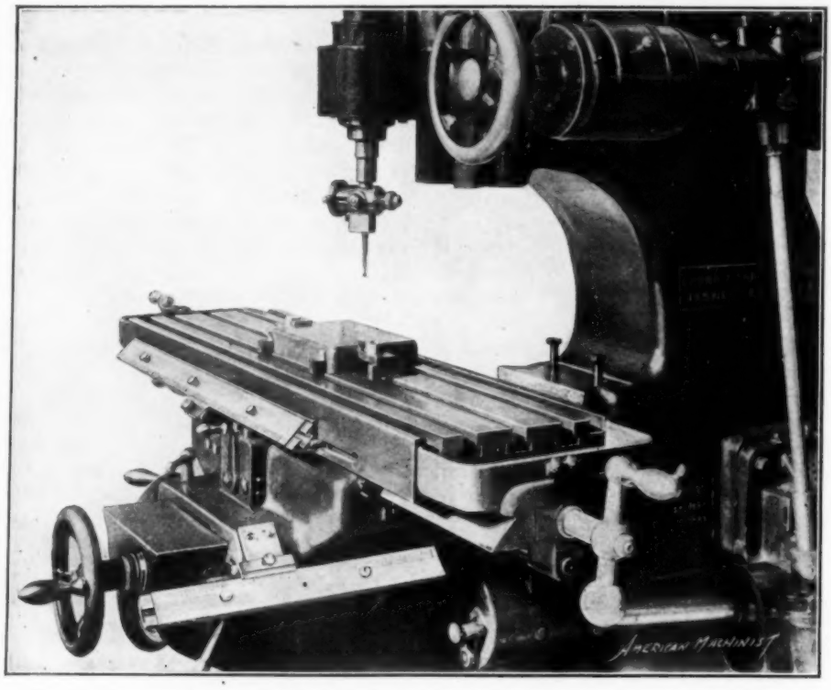


Fig. 2. Brown & Sharpe Vertical Spindle Miller Arranged as a Tool Room Laying-out Machine

For those angles for which they will suffice, the adjustments are made directly from the notched plate. For smaller angles the graduated circle and adjusting plate *C* are used, an index pointer *G* on the latter traversing the graduations on the former. Plate *C* may be clamped to the notched plate *B* by means of the capstan-headed screws shown, and when these are loosened it may be adjusted for the angle by means of the adjusting screw *H*.

The notched plate and the graduated circle may be used in combination when necessary. The notches give angles of 22½ degrees directly, and if we need an angle of say 30 degrees we first move the work one notch of the notched plate and then get the remaining 7½ degrees by means of the adjusting plate, which has a range of about 40 degrees.

Instrument makers will supply graduated circles of a degree of precision equal to anything made in the machine shop, and with such a circle and a glass for reading it, such a tool as the one shown may obviously be made to give results of the highest degree of accuracy. In our own case the circles were made at home by means of the index head of a universal miller, and they have been found sufficiently accurate for all the work which we have had occasion to make.

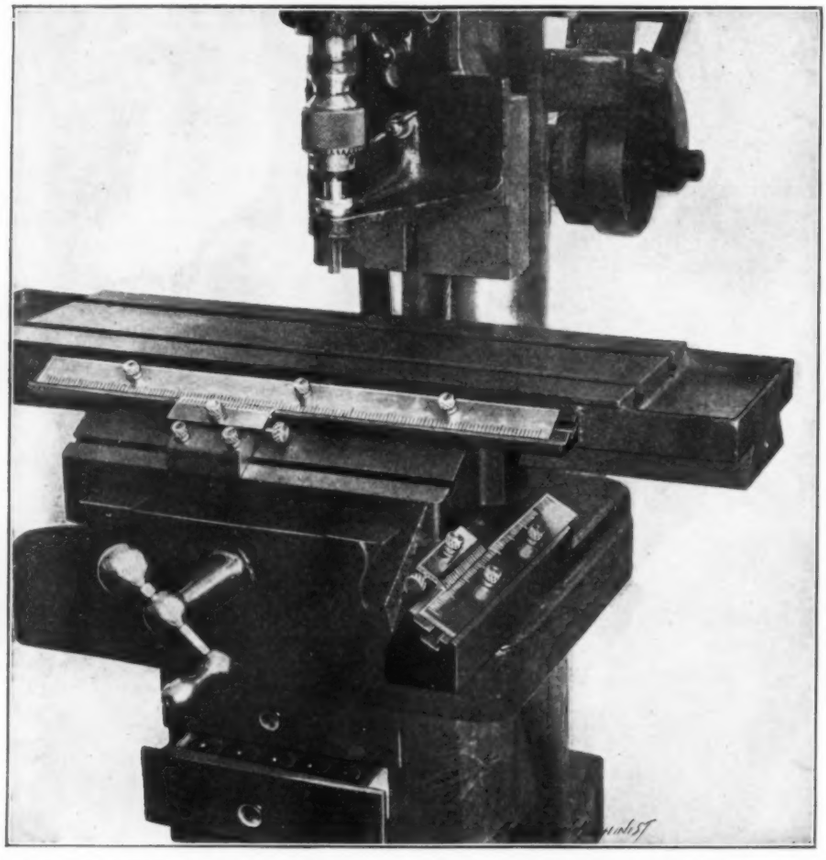


Fig. 1. Sigourney Vertical Driller Arranged as a Tool Room Laying-out Machine

The exports of metal-working machinery for March, 1911, were $900,000 against $700,000 for the same month of the previous year. For nine months ended with March, 1911, the exports of metal-working machinery reached $6,800,000, while the same period of the previous year showed $4,200,000 in exports.

Letters from Practical Men

Concerning the details of making things in machine shops, from the first sketch to the shipping room. A letter good enough to print will be paid for. The value is in the idea—not the length of the letter

A Turret for the Engine Lathe

In the line cut, Fig. 1, is shown an engine-lathe turret recently made by us for our own use. It is made more particularly for chuck work, though it could very easily be adapted for ordinary turning between centers if so desired.

The turret proper revolves in a block which is bolted to the slide which in turn fits onto the cross slide; a taper pin crosswise, locates the turret in the central position.

The turret is clamped, when extra heavy cutting is to be done, by a bent-box spanner on the hexagon-head screw.

Two good features of this clamping arrangement are that the clamping bolt does not revolve with the turret, consequently the spanner always clamps in the same position, and that the clamping arrangement is entirely independent of the ordinary working adjustment.

The turret plunger, which is of tool steel hardened at the business end, fits into hardened tool steel bushings and is operated by means of a handle fitted to the shaft of a pinion, meshing with rack teeth cut on the plunger. The plunger is bored out from the lower end so that a comparatively long spring can be used.

Each of the six faces of the turret has a 2⅛ inch diameter hole for drills, reamers, etc., with a suitable clamp bolt *A*, and also four ½ inch diameter tapped holes, in order that special tool holders may be more firmly secured than would be possible if there were only a round shank.

The 2⅛ inch diameter holes are bored in position (the turret being located in the central position) with a single-point tool held in the chuck. Each face of the turret is machined by a milling cutter which is either held in the chuck or else on the spindle nose of the lathe, the regular cross feed being used.

Fig. 2 shows a very useful tool holder for use on this turret. It was designed primarily for turning the face of the rims and bosses of change gears simultaneously, but it can be used on other jobs, in some cases, possibly, to better advantage than on the work for which it was specially designed.

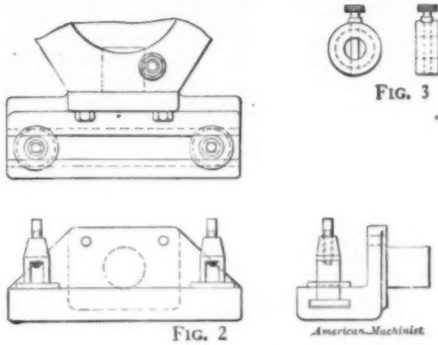


FIG. 2

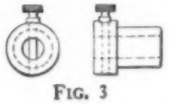


FIG. 3

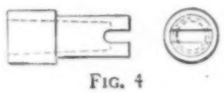


FIG. 4

TOOL HOLDERS FOR ENGINE-LATHE TURRET

It is an axiom of turret-lathe practice that as many tools as possible should be in operation at the same time, so that the output will be large in proportion. As shown in Fig. 2 provision is only made for two tools, but where the work allows of a larger number all that is necessary is to provide one or more extrat tool posts.

The arrangement of the tools is so flexible and of such wide adaptability that it is practicable to do many classes of work with it. For example say, an 18-inch diameter plate was to be faced up. If two tools were used 4½ inches apart it would take only about half the time that would be required if only one tool were used; again in the case of gear blanks, similar to change gears, one tool can be set to turn the rim and the other to turn the boss—this not only saves time because of the two cuts proceeding together but much turning of the cross-feed screw by hand is avoided on account of the shorter length of feed required.

The tool holder is secured to the turret by two ½-inch screws and is further supported by the shank, which, of course, closely fits the hole in the turret.

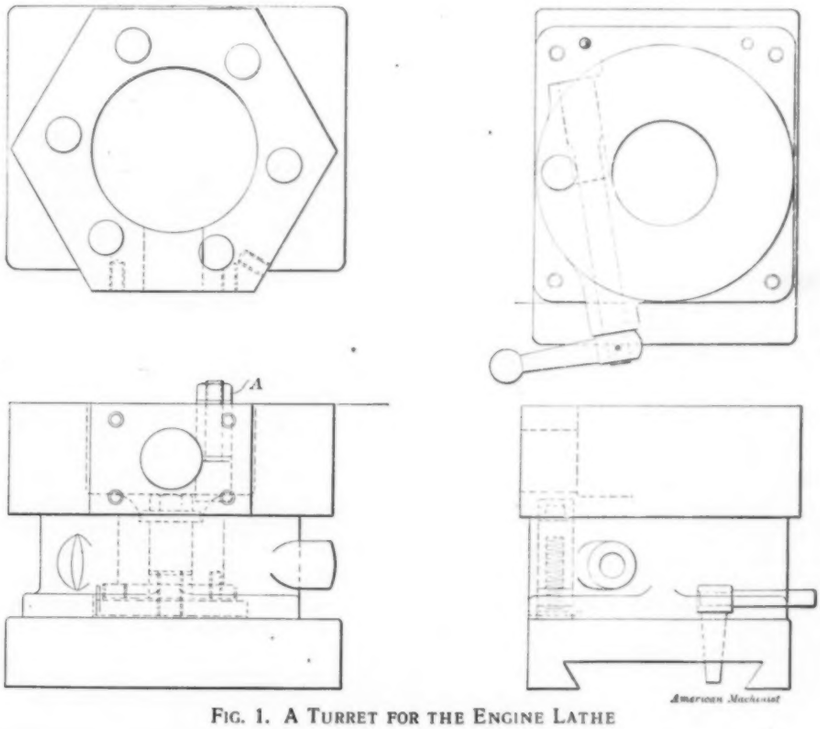


FIG. 1. A TURRET FOR THE ENGINE LATHE

Fig. 3 is a floating reamer holder. The reamers used in this holder are kept from rotating by the ⅜-inch pin which is a loose fit in a hole in the shank of the reamer.

A drill holder is shown in Fig. 4. No description of this is required, though it might be mentioned that it, as well as the reamer holder, is securely fixed in the turret by a clamping bolt similar to *A*, Fig. 1.

Yorkshire, England. RACQUET.

A Vertical Milling Attachment for the Slotter

One of the difficulties the manager of the small jobbing shop has to contend with is the fact that neither his work, nor the owner's purse, warrants the outlay in buying new machine tools for the jobs which occasionally come along, consequently all kinds of makeshifts have to be resorted to.

I was once connected with a small jobbing shop where we occasionally had jobs requiring a vertical miller, but we could not afford to buy one, so we designed the attachment shown herewith, to fit a 9-inch stroke slotter, and it exceeded our most sanguine expectations. It takes about twenty minutes to fit the attachment, and thereby convert the slotter into a vertical miller, as the feed motions of the table, when used as a slotter, answer all the requirements of a vertical miller. The only alteration to the slotting motion is to uncouple the connecting rod which gives motion to the ram, and bolt the bracket *A* to the ram *B*, by three bolts passing through it and fitting in the T-slots in the end of ram. Tongues are also planed on *A* to fit in these T-slots, to locate the bracket in position. *A* is bored out to receive the turned sleeve *C*, which carries the spindle *D*. Two locking rings *E* are screwed on the spindle to take up end play. *F* is a boss cast on the side of *A*, as shown in Fig. 2, and is bored out to receive a steel pinion with a square end, shown at *G*. This pinion gears in with a rack cut in the side of the sliding sleeve *C*, and is used for giving the cutter spindle vertical movement. The sleeve is locked by the two bolts *J J*, and has a fiber packing washer in a milled slot for adjustment; *H* is a ball thrust to take the pressure when end milling, or keyway cutting.

The top bracket *K* is clamped to the ram V-slides, there being no drilling whatever on the machine, and is bored out to receive the sleeved driving pulley *L*, which is secured by the two locking rings *M*.

Slackness is provided against by the two bolt holes and bolts shown at the side, in Fig. 2, which clamp the bracket *K* on to a fiber washer in a saw slit. By this method the belt strain is not thrown on the spindle, but is carried by the bracket *K*; the driving pulley *L* has a feather key let in, and drives the spindle *D*, which has a keyway milled along the top end.

N is a gray-iron bracket secured to the frame of the machine as shown, by four setscrews, and carries two guide pulleys *O* on the pin *P*, to guide the driving belt from the pulley *R* to the spindle pulley *L*.

The drive to the cone pulley is obtained by the usual slotter belt operating on the small cone *Q*, and thus giving the necessary high spindle speed.

This device is very simple and cheap to make, it is quickly attached, and does all our work with accuracy and despatch, and compares favorably with a much more expensive miller, which we could not keep half occupied. The idea was a new one to me, and suggested by our foreman, and I am surprised that it is not more widely adopted in small jobbing shops. Of course, the ram must be locked in the slides when using this attachment.

Birmingham, England. MILLER.

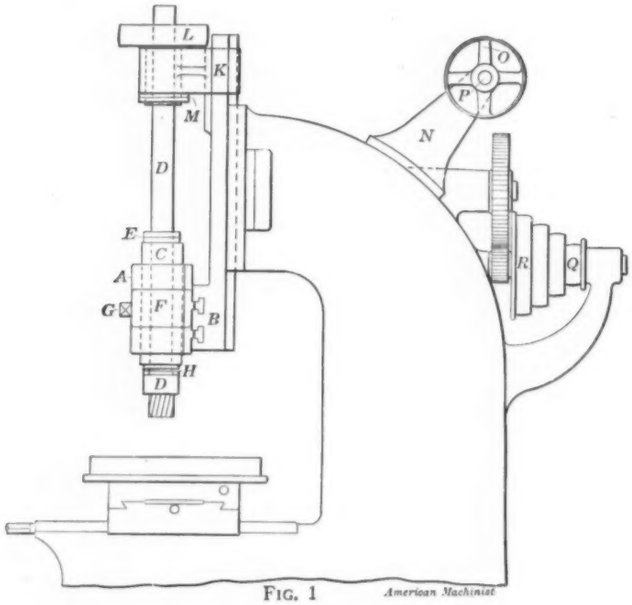


FIG. 1

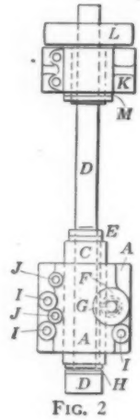
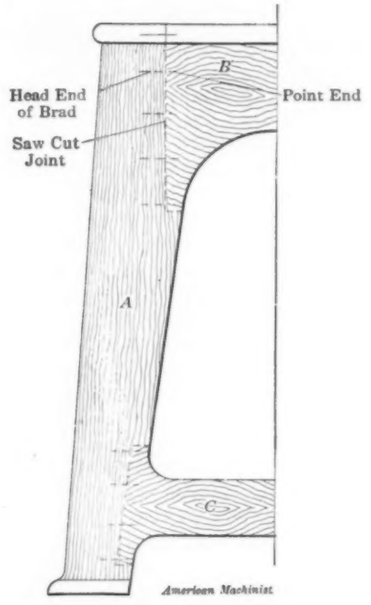


FIG. 2

A VERTICAL MILLING ATTACHMENT FOR THE SLOTTER

Pattern Making Kink

The line cut shows a section of a machine leg and also my method for making these an like joints, in pattern construction.



METHOD OF JOINING PARTS OF A PATTERN

A band saw for cutting the side pieces, and metal-frame miter saw for cutting the ends of cross pieces are the only tools used.

Headless wire nails, made by cutting the heads off the stock nails or brads, are driven into the side pieces *A* leaving about ½ inch, ¾ inch or 1 inch of the points protruding.

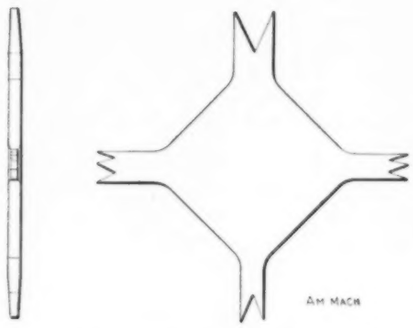
The members are placed on a flat board or faceplate in their relative positions and forced together after glue has been applied to the joints, the protruding ends of the nails entering the cross pieces B C. If a little attention is given to inserting the nails they will hold the members in place even after the joints are separated.

Kenosha, Wis. E. SWANSON.

Creaser for Lettering Guide

I am sending you a drawing of a little device for spacing titles, which I have used for some time and find very handy.

It is made of sheet brass about 3/64 inch thick. The points are filed to a blunt edge, and the spacing of the points



CREASER FOR LETTERING GUIDE

may be made to suit the size of letters to be made.

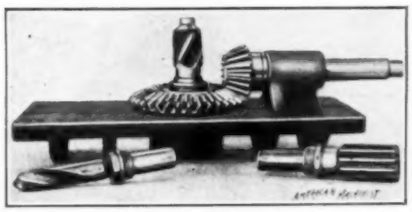
Grafton, N. D. PAUL VLASEK.

Ingenious Drilling Device

The machine shown in the illustration was made for the purpose of drilling through the wall of cast steel that surrounds the piston rod and separates it from the cored chamber, for water cooling in the pistons of large gas engines.

The water is forced in at one end of the piston rod, circulates around the interior of the piston and passes out at the other end of the rod.

The device consists of a driving pinion that meshes in two bevel gears, or, a gear within a gear. The inner steel gear drives the spindle that carries the tools. The



AN INGENIOUS DRILLING DEVICE

outer bronze gear engages the threaded spindle. It has one more tooth than the inner, or driving gear, and gives a constant and a positive feed, in this case 0.005 inch per revolution.

It was made to go in a 7⅝-inch bore, but with the use of cradle liners, we work it in bores up to twelve inches. It has a spindle travel of four inches and we drill and ream holes up to 2½ inches diameter.

The illustration shows a drill of 1 1/16 inches diameter, a 1⅞-inch reamer and the reamer drill in position.

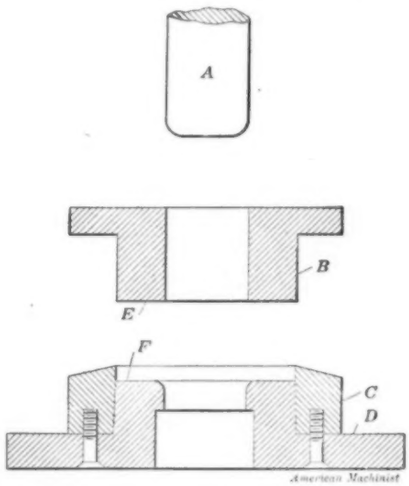
The drilling of these holes formerly occupied two men, with a ratchet, 18 hours. By coupling this machine to the spindle of a horizontal drill press, we do this job in 3½ hours. This scheme can be used in most any size hole and at any reasonable depth and for a variety of operations.

Bethlehem, Penn. J. F. VAN HORNE.

Drawing Brass Shells

The article described by H. Maddison, on page 265, on the method of making dies for drawing brass shells is interesting; but the method is rather slow for producing this class of work.

He first of all cuts out the blanks in a separate pair of dies, then places them (one at a time) in the recess made in the guide plate; then screws down the threaded guide plate with a tommy-key, or lever, onto the blank to keep the wrinkles out. This causes the breakage



DIES FOR DRAWING BRASS SHELLS

of some of the blanks or shells. Again, after each shell is drawn, he must unscrew the guide plate, and place in its former position before he can insert another blank.

If the dies are made according to the line cuts shown, it will reduce the cost of die making considerably, and at the same time increase the output by at least three or four hundred per cent.

In the illustration *A* is the forming punch; *B* is the cutting punch and blank holder; *C* is the bottom cutting ring; *D* is the forming die.

The dies, as illustrated, are for use in the double-action press, but the single-action press could be used, by boring out the slide for the forming punch to work through and connecting the slide itself by means of rollers and springs, to two cams fixed to the cheeks of the crank shaft, and attaching the cutting ring *B* to the slide. It will readily be seen that the dies are of the cut-and-draw type.

The stock is placed on the bottom die and as the cutting punch *B* descends it cuts out the blank and carries it down to the face *F*, where it is held between the faces *E* and *F*, while the forming punch *A* descends and forms it up to the required shape.

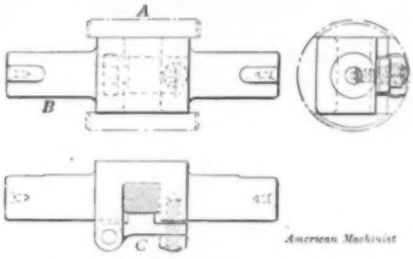
If the pressure is regulated properly between the two faces *E* and *F*, wrinkling and breakage would be reduced to a minimum.

Swansea, England. A. WHITBY.

Arbor for Turning Armatures

The accompanying illustration shows an arbor for turning magneto armatures or similarly shaped pieces.

A is the armature, which is clamped to the arbor by the hardened clamp *C*. The diameter of the armature is left 1/32 inch larger than the finished diameter. The sides are finished to the exact size.



ARBOR FOR TURNING ARMATURES

After assembling the armature is turned and ground to exact size.

Detroit, Mich. E. E. HIRSCHHAUTER.

Method of Testing T-Squares to Angles

Another "draftsman's kink" is shown in the line cut. I have marked the fixed head of my tee-square with lines so that

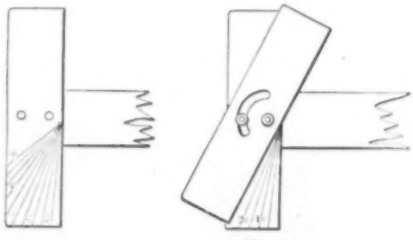


FIG. 1 FIG. 2

SETTING T-SQUARE TO ANGLES

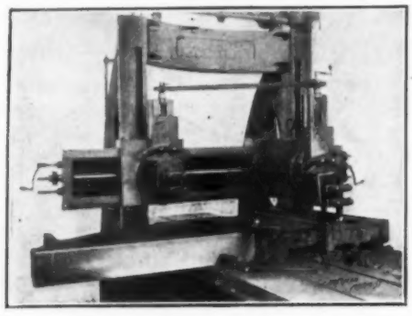
I can readily set the square to any angle, very quickly, without recourse to a protractor. This method gives the angles with sufficient accuracy for ordinary work.

Figs. 1 and 2 show clearly the way of doing this. The head is marked on both sides with lines one degree apart. Fig. 1 shows only one side marked with five-degree lines for the purpose of illustration. Fig. 2 shows the tee square set so that when turned over and the swivel head is against the drawing board, lines may be drawn 25 degrees with the horizontal.

New York City. ETCHES.

A Vertical Feed for Planer Extension Head

The illustration shows a vertical feed for the extension head on the planer and was originated by me, although the idea may be an old one. The method of constructing it is: Place two 6-inch pulleys



VERTICAL FEED FOR PLANER EXTENSION HEAD

on the screw of the heads, one on each; put the tool in place and lock the head; place belt on pulleys and take up the slack by running the idle head over. Throw in your lever for the vertical feed and you will find that it will work properly.

Franklin, Penn. P. M. JONES.

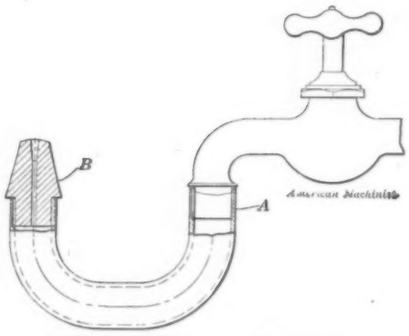
A Homemade Relieving Attachment

The halftones show a relieving attachment for worm hobs. The bracket *D* supporting the gear *B* is bolted to the carriage. Mounted on the end of the same spindle with *B* is the cam *A* which rides on a guide pin attached to the cross slide of the lathe. The cross-feed screw is thrown out of engagement with its nut so that the cross slide is free to reciprocate. The guide pin is made of a piece of flat steel, one end of which shows at *E*. The springs *F* hold the guide pin against the cam *A* while the hob is being relieved, but when the lathe is reversed the cross slide and attached guide pin are forced back so that the cam can clear the guide pin while the tool, in the compound rest, is drawn forward out of the way of the work. The gears *C* and *B* are in the ratio of 2 to 1, a 5- and 4-toothed cam taking care of 10- and 8-fluted work. The gear *C* is keyed to the mandrel on which the work is mounted.

New York. E. A. DIXIE.

Improvised Bubble Fountain

When the hue and cry was raised about the danger of drinking from public drinking fountains and cups, I witnessed an ingenious piece of workmanship. In the machine shop where I was working, a fellow machinist decided to make a bubble fountain out of the



IMPROVISED BUBBLE FOUNTAIN

faucet, from which the water runs at approximately 30 pounds pressure per square inch.

A piece of brass tubing about 10 inches long and 1 inch diameter was threaded at both ends inside; one end having the same thread as the mouth of the faucet. The tube was then bent to shape shown in the line cut. When that was done, the pipe was secured to faucet at *A*. An odd piece of steel was then machined to the size and shape shown at *B*, and threaded the same as that end of the pipe to which it was to be fitted. The next thing done was to drill a 3/32-inch hole through the mouthpiece *B* and taper it at the top.

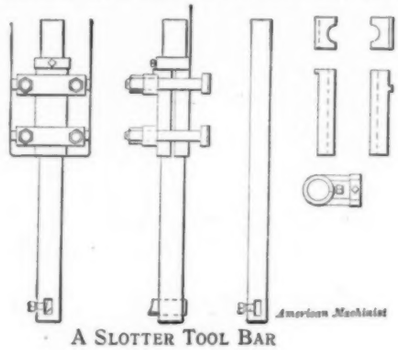
This size of hole so reduced the water pressure that the water spurted out only 3 inches high, at full force. Screwing the mouthpiece into the pipe completed the "bubble" fountain.

ROBERT LEACH.

Somerville, Mass.

A Slotter Tool Bar

The line cut shows a first-class slotter tool bar. It is made of 2¼-inch round machine steel and can be made any size,



A SLOTTER TOOL BAR

by simply using bushings to fit the half-circle bar clamps. This style of bar is very handy as the tool can be turned around to any position required by loosening the clamp stud nuts. It will also be noted that the ⅜-inch lips on the two-bar clamps hold the clamps from dropping out of place when the holder nuts are loosened.

When this bar is once set to length the collar on top of bar prevents it from dropping.

CHARLES MARKEL.
Shop Foreman, C. & N. W. Ry.
Clinton, Iowa.

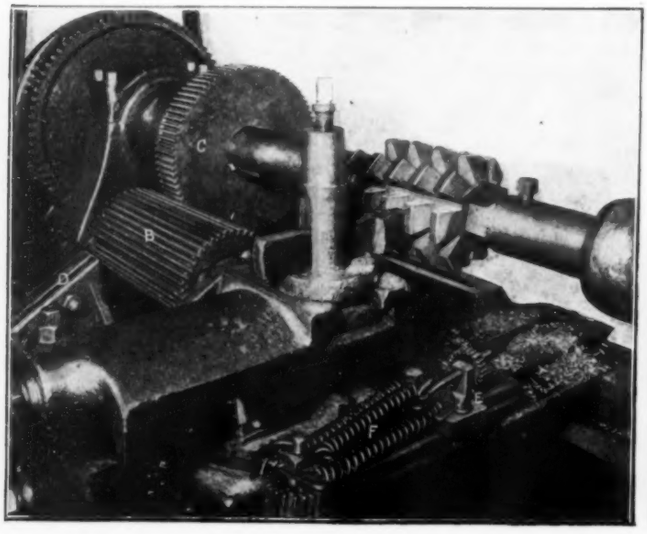


FIG. 1

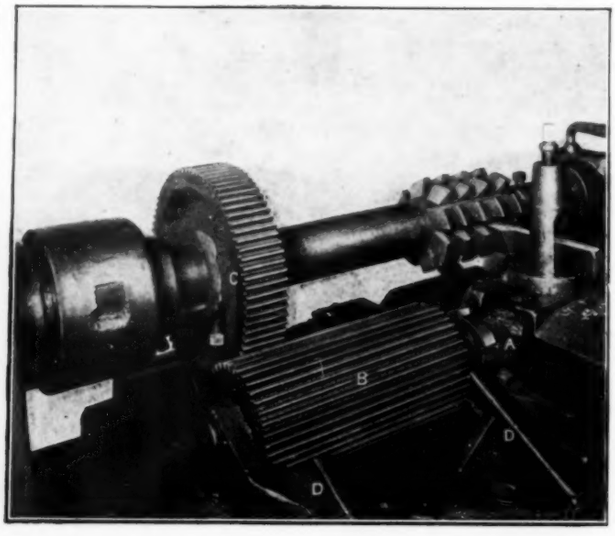


FIG. 2

A HOMEMADE RELIEVING ATTACHMENT

Discussion of Previous Question

Letters from our readers showing how many men of many minds look upon various subjects opened up in previous numbers

Efficient Record and Route System

I have read the many contributions on the above subject which appears in the AMERICAN MACHINIST from time to time, all of which are interesting, but especially the one described by Mr. Norris on pages 251 and 297, but one and all leave off with half of the story untold. No one seems anxious to point out the numerous failings of the system, that are found in every one yet invented. I am at present engaged with a firm which has a fair amount of standard work. (We pass out some 250 large and small orders per week.) Many of these orders have something special about them—out with our standard. We ship to almost every civilized port in the world. An ideal case for the use of a system! We have a good one, such as it is, but I will not describe it here. Its failings and shortcomings are too numerous to mention; sometimes it is miles behind, but never in front of the human element, engaged in doing its best for the firm and its customers. We, the readers of this journal, representing the premier countries of the world (as far as engineering is concerned), each one is doing his utmost to capture a slice of the world's trade for his own country. A healthy rivalry exists. Cables are passing, hasty conferences are held and councils of war occasionally. "Do it now" goes forth, and system follows on, no matter how efficient.

Numerous instances could be given from my own experience during the past 20 years of the failure of systems among firms in Britain and the States; but I will be content to give one glaring case in the form of a problem, the solution of which would prove interesting.

On the banks of the Clyde, near to Glasgow, is the works of a well known sewing machine company. Its organization should be above question. It turns out thousands of sewing machines per week. A short time ago its machine parts were being sold in the north of England at less than cost price. It took months to find the source of supply, and this was accomplished not from inside but outside of the works. At the subsequent police-court proceedings it was stated "that it was almost impossible to detect the leakage from within."

Had these parts been sold at the usual retail price would the theft ever have been discovered, and what is the solution? Was this plant over or under systematized?

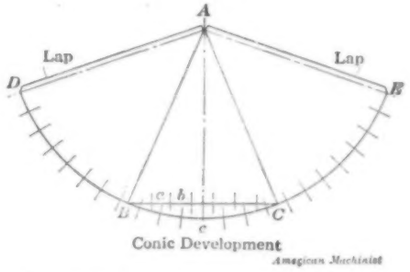
Belfast, Ireland. TERRY.

Patterns for Sheet Metal Cones

I was interested in the article, "Patterns for Sheet Metal Cones," on page 654.

There are many methods of obtaining conic developments, but the one that I have used for many years, and which has proved very satisfactory and is free from calculation, is shown in the line cut. Let *A B C* be a cone of which a development is wanted.

First divide the base *B C* into seven equal parts. Then lay off 11 of these parts *a b* on each side of *c*. Through the



PATTERNS FOR SHEET-METAL CONES

last points *D* and *E*, draw the lines from apex *A*, *A E* and *A D*. Then the sector *A D E* is the conic development.

Holyoke, Mass. C. W. PUTNAM.

Machinery Bearings

I have read with interest the discussions as to the relative merits of the cast-iron, bronze and babbitt bearings for machine tools, which have recently been printed in the AMERICAN MACHINIST.

I differ a little from Mr. Williams in his opinion as expressed on page 462.

I have had experience with shafts running in bronze bearings that have run dry enough to cut the bearing, and the shaft loaded up with the bronze in a few revolutions, so that much draw-filing became necessary to free the shaft of the bronze. In some instances the shaft would be scored or cut, also.

Babbitt will do the same thing to soft-steel shafts under certain conditions. In one instance a cast-iron shaft running in a bronze bearing, through lack of proper attention, had worn the shaft so thin at its bottom as to cause the box to hug the shaft so that oil did not lubricate. When I was called to make the repair, the cast iron and the bronze had become so closely united, that I had to use a cold chisel to remove the bearing from the shaft. The shaft was then put in the lathe and a light chip taken to remove the particles of bronze.

In answer to Professor Sweet's question, "Why should machine tools be allowed to run dry?" I should like to give my opinion. I believe machine tools are often not provided with proper oiling devices. I think that machine tools should be provided with sight-feed oil cups, wherever possible, then the operator could tell instantly when oiling was necessary. Many an operator will not bother to oil the machine until he finds he really must and then it is usually too late. At other points on the machine, where sight feeds cannot be used, some better device for oiling than that in general use should be provided, some device that will keep out all small chips and other foreign material.

Referring to R. K. Le Blond's article, page 537, I would like to give my experience with bronze, babbitt and cast-iron bearings on a heavy, high-speed machine.

Seven years ago I was given the repairs to make on a large number of machines, the journals of which were of cast iron. The bearings were of bronze set in cast-iron foot blocks. The total weight of the machine as it rested on the bearings was 115 pounds. It was driven by a tight, short belt, from beneath, the pull of which added much to the weight upon the bearings.

The speed of the machine varied from 1300 to 1400 revolutions per minute. Upon examination, I found all the machines running hot in spite of the fact that they were receiving oil continually. I was told to find the trouble and remedy it. There were three journals to each machine and these journals were slightly larger at the center than at either end. I found the journals on nearly all the machines had worn into the boxes so deeply that lubrication was impossible.

I ordered new bronze boxes, but these lasted barely two or three weeks. Oil grooves were cut in the next lot, but the result was the same. Next, we tried babbitt boxes cast and fitted to the foot blocks as were the bronze bearings. These boxes worked better for a time and did not heat much, but soon it was found they were working loose and pounding

themselves brittle, after which they would either crack or heat and stick. With much hesitation a cast-iron bearing was tried and after several days with careful oiling, it was found that they had completely glazed, and the journals were also glazed. These bearings are still in use on the same machine, thus proving to me that in this particular case and under these conditions even with cast-iron journals, the cast-iron bearing was far superior in its efficiency to either bronze or babbitt.

Gorgona, C. Z. FRANK ROSE.

Turning Spokes Round at One End and Oval at the Other

If D. C. King, as he says on page 650, wants to turn spokes as above, probably the most simple way is to put a rotating, wabble center in the tailstock of his lathe, gearing the center to rotate twice while the spoke turns once, and have the tail center wabble one-half the difference between the long and short diameters of the oval end.

Syracuse, N. Y. JOHN E. SWEET.

Testing Automobile Valve Springs

In a recent number of the AMERICAN MACHINIST a few suggestions were given for finding the value of E for springs. Since springs play such an important part in the gasolene engine, the following convenient way of testing small springs

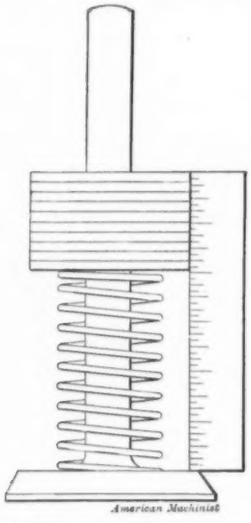


FIG. 1. TESTING AN AUTOMOBILE-VALVE SPRING

may be of general interest. All that is needed is a balance reading to ounces, an ordinary gasolene-engine valve, a few washers and a steel rule.

The valve is placed on the balance with the spring slipped over the stem, as shown in Fig. 1. The weight is noted and the length of the spring measured. Then washers are added, one at a time, and readings taken of weight and length of spring between each two increases of load. First the weight is observed, then the steel rule is set alongside of the spring, as shown, and read to as close a figure as desired. This will disturb the balance, but since the weight is already noted this does not affect the accuracy of the determination.

By taking a number of readings and then plotting them, their accuracy is at once evident. An average obtained by inspection of the curve will give a dependable value of the deflection to be used in future computations for similar springs.

The accompanying curve, Fig. 2, was

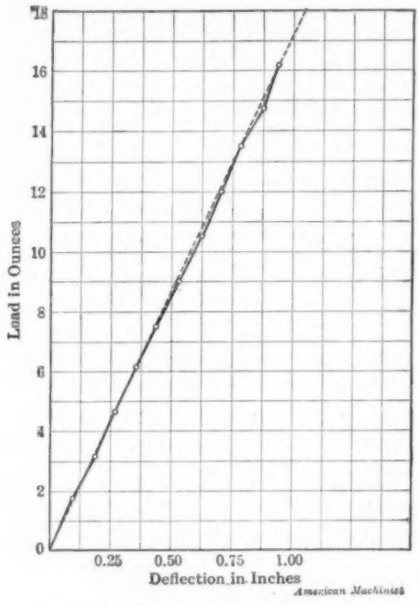


FIG. 2. CURVE OF SPRING TEST

obtained by the above method. Note the almost straight line joining the different readings, showing that the errors are extremely small.

GEORGE M. STROMBECK.

East Moline, Ill.

Responsibility for Good Work

When I think of how often men have brought me a hack saw with the advice to cut off my hammer handle, or I have seen a supposed imitation of how I was filing a job, or think of various other "knocks" that one gets in different shops, I am quite ready to agree with Entropy that there is too much sarcasm indulged in about the methods of men in doing a piece of work.

Let us always remember that there is more than one way to kill a cat.

The most discouraging thing about it is the fact that most of these criticisms come from men of limited experience; men who have spent their lives in one or two shops, perhaps, and seldom from those who have traveled and gained a broader vision, in many shops, by contact with many men and methods.

But I do not agree with Entropy when he claims vast superiority for the mechanic of former years. It is true that he was a man of greater general experience—blacksmith, tinsmith, patternmaker and all that sort of thing.

However, the mechanical arts have become infinitely more complicated since then. This is an age of the specialist, because finite life is too short to crowd into it the mastery of an infinite business. Could the mechanic of 30 years ago step into the intricate mechanical industries of today, and prove superior to his Twentieth century brother? I think not. I know such men of the "old school," who cannot do the most important work now nor draw the biggest salaries.

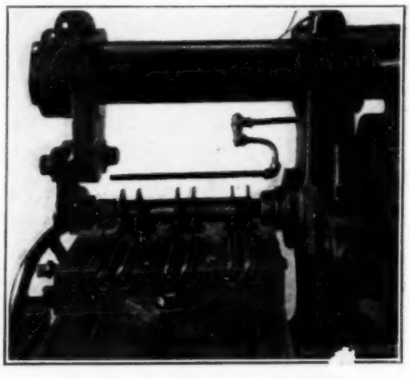
Entropy complains that we cannot get men unless we import or make them. Alas! from whence does he propose to import them? Where is that land, which, in the broadest sense of the word, can boast greater mechanical advancement than the United States?

Buffalo, N. Y. ARTHUR F. KUNZE.

Chuck for Splining Spindles

Noticing an article, page 653, entitled "A V-block for Splining," I thought it might be of interest to show you the chuck we made for splining spindles for blacksmith drills.

These spindles are 1x1⅛ inches and the chuck will hold six at a time. By using gang milling cutters we have increased our output on this article from 190 to over 500 per day.



CHUCK FOR SPLINING SPINDLES

The illustration does not require much explanation. I will only say that the side of the chuck which takes the thrust has a hardened steel plate, set in, to keep it from wearing a ridge or hole in it and spoiling the alinement of the spindle.

The center blocks are also hardened steel and are made so they will move ¼ inch sidewise. There are two slots on the bottom of chuck in which are the nuts on the end of the four screws which hold down the center blocks. These screws are not touched at all during the operation of putting in and taking out.

The holes in the bottom of the chuck through which the screws go are, of course, oblong. To change the work it is only necessary to loosen the two large screws in front of the operator, and it is done very quickly.

Salem, O. ARTHUR HARWOOD.

Do Taylor's Methods Increase Production?

In an editorial on page 463 there appears the following statement: "To the movement toward intensive production Mr. Taylor has been a leading contributor through his invention of high-speed steel, but not otherwise."

While I believe that Mr. Taylor has contributed a great deal to the advance which has been made in recent years in shop management, it is not my purpose to attempt to deal with the general subject, but I desire to record the benefits that I have derived from Mr. Taylor's teachings and to record the fact that by an adherence to his general principles of management many thousands of dollars have been saved in a Government establishment.

While on duty at the navy yard, Mare Island, California, I became convinced that the application to the work under my charge of the principles of management advocated by Mr. Taylor would result in large savings. Having reached this decision I attempted little by little to introduce his methods. Of course, many obstacles were encountered, and I labored under the disadvantage of having had no previous experience with these methods. I did not hesitate to write to Mr. Taylor to tell him of my difficulties and by means of correspondence and one visit to him I received great assistance in smoothing out these difficulties.

After about two and a half years' work a very fair start on the road to scientific methods was made. No attempt was made to establish a scientific rate department, nor was any attempt made to give detailed instructions to the workmen. The work was routed by a planning department and each workman received written instructions of the work to be accomplished but was not told *how* to accomplish it.

Practically all of the work was under the day-work system, and it was my aim to raise the standard of efficiency as high as possible under this system before going to any bonus system for the payment of labor. It was, of course, not practicable without scientific rate making to go to Mr. Gantt's bonus system or to Mr. Taylor's differential piece-rate system. In fact, I did not contemplate using either; I expected to use the Halsey premium system for the great mass of the work, and straight piece work on a small quantity.

In view of these explanations no doubt many will consider that Mr. Taylor's principles of management were not followed, but I know that in every change that was made the fundamental principles enunciated by Mr. Taylor were always the guide. If general principles only are adhered to, details can be made to suit conditions, many of which it is oftentimes impossible to change.

Without going into details regarding methods, I can state that the teachings of Mr. Taylor were adhered to in the following named important points:

1. Functional duties for the officials of the establishment. Detail written instructions establishing the duties and responsibilities of each officer.
2. Functional duties for the supervisory force in the various shops with detail written instructions describing the duties and responsibilities of each.
3. A planning department which carefully planned for each shop the work to be accomplished, and routed the work.
4. A careful analysis of the work to be accomplished and a study of the best means to be employed before the work is undertaken.
5. Detail written instructions to each workman of the work to be accomplished.
6. The establishment and maintenance of standard methods of doing work and for caring for equipment. For example: standard tools, standard methods for caring for belts, machine tools and other appliances.
7. A detail investigation of methods of doing work. This was accomplished by means of stop-watch unit-time studies, which brought to light many defects in organization, in equipment and in methods followed.

RESULTS

The Mare Island navy yard labors under the disadvantage of a limited supply of skilled mechanics and high daily wages. First-class mechanics at this yard receive from 52 to 63 cents an hour, while helpers and laborers receive 30 to 33 cents an hour. It would seem that the high cost of labor would have brought forth the best efforts to secure good management. Such, however, was not the case; the very fact that labor wages are high brought about the assumption that Mare island could not compete with other navy yards. When high costs were reported conditions were not investigated, as it was assumed that the high cost was due to high wages.

Since the principles of scientific management have been followed there has been a remarkable increase in the output and reduction in cost, and it is entirely due to the adherence to these principles that this establishment has been able to compete with Eastern navy yards where wages are much lower and the cost of material is less. It will not be possible to give the numerous cases where marked reductions in cost have been made, but a few examples will be given to illustrate general conditions.

IN SHIPBUILDING

Under this head there is work in a large number of shops, machine shops, foundry, shipfitters' shop, joiner shop, electrical shop, coppersmith shop, sheet-metal shop, etc.

A large collier 450 feet long was built at the Mare Island yard, and a sister ship was at the same time built at a large Eastern navy yard. The two ships are identical, being built from the same detail plans. The wages at Mare island are approximately 25 per cent. greater than those of the Eastern yard; the structural material for the Pacific coast-built ship was necessarily obtained from the East and owing to transportation charges the cost was at least 25 per cent. greater than on the East coast. The cost of the ship built in the Eastern yard should therefore be approximately 25 per cent. less than the Western built ship, yet the Pacific Coast yard, employing some of the fundamental principles of scientific management built the ship for $100,000 less than the Eastern yard.

IN BOAT BUILDING

A large number of small boats are each year built in the navy yards. As the boats are of standard design a direct comparison of costs can be obtained, and the amount saved on new boats by improved methods can be determined. At the Mare Island yard, in two years' time, the application of scientific methods of management reduced the cost of boats to approximately one-half previous costs and on the output of new boats in two years there was a saving on previous costs of over $25,000. In addition to the new work there is a large amount of repair work in this shop and the improved methods have greatly decreased the cost of this work, but the savings effected on repair work cannot be determined.

IN WOOD CALKING

Practically all of the wood calkers on the Pacific coast belong to an association. This association is very powerful and very few care to antagonize it. The number of apprentices is limited and the output of the men is limited. Wages are very high, $5 and $6 a day being the prevailing wages. The calkers at the navy yard received $5 a day and they seldom ever reached in output the limits set. I was satisfied that the output was far too low, but for a long time was unable to increase it.

Finally, after educating some men who could take the places of the calkers in case of trouble, and carefully ascertaining the amount that a first-class man should do, I fixed a piece-work price which would allow the men to make from 50 to 60 per cent. more than their

day's wages and put all work on piece work. To enable these men to earn the 60 per cent. above day wages, it was necessary for them to do 3½ or 4 times as much as was being accomplished at day work. The situation was finally accepted and in a few weeks the men were actually doing from 3 to 4 times as much as was done before. It is now necessary, on account of the large output, to employ but a small number of men, and these are the very best of their class. They make large wages, are perfectly contented and never give the management the slightest trouble. The output now obtained is far above that obtained in other establishments in the vicinity and I believe exceeds the output obtained in Eastern establishments. The average output for representative classes of work is as follows:

On new work: Decks, three threads, 380 feet in 8 hours; sides and bottom, four threads, 265 feet in 8 hours.

On old work: Reave out putty, harden down, and calk one thread, 425 feet in 8 hours; reave out glue, harden down, and calk one thread, 380 feet in 8 hours.

In Canvas Work

As soon as the work was in some degree systematized a record of the daily output of each man was made. These records speak for themselves; a few will be given to illustrate the improvements made:

Workmen	First Records	Date, 4-13-10	Date, 4-16-10	Date, 4-20-10	Date, 4-22-10
1	120	78	72	72	..
2	120	78	78	78	..
3	120	90	90	90	..
4	120	90	84	84	..
5	120	90	84	84	..
6	120	96	84	90	..
7	120	102	102	90	..
8	120	120	120	108	72
9	120	120	120	108	72
10	120	120	120	108	90
11	120	120	120	96	84
12	120	120	120	120	90
13	120	120	120	96	96
14	120	120	120	96	96

TIME TAKEN IN MAKING STANDARD NAVY HAMMOCKS IN LOTS OF TEN, ALL WORK BY HAND, MACHINE WORK NOT ALLOWED. TIMES GIVEN ARE IN MINUTES FOR ONE HAMMOCK

The reductions made reduced the cost of hammocks 75 cents each, and as large quantities are required, 2000 for a single large ship, the saving effected is considerable. The time required in making clothes bags, 2000 of which are required for each large ship, was reduced from 60 minutes each to 36 minutes each.

The most interesting reduction, however, was made in the manufacture of 800-pound coaling bags. The record of the times, taken after the material is prepared, is as follows:

For exactly the same work it will be seen that the time was reduced from 390 to 132 minutes per bag.

Cutting out, folding and creasing, and cutting ropes to length, in lots of 100, require seven minutes each; diagonal stitching the sides and bottoms on the machine in lots of 100 take 25 minutes each. The total time taken by the best workers to make a bag complete is therefore 2⅔ hours. When the diagonal stitching is done by hand, the time for each bag is 3¼ hours. These bags are well made, being subjected to very hard usage in coaling ship, 800 pounds of coal being hoisted in each bag.

It must be admitted that to make one of these bags by hand in 3¼ hours requires skill and hard work. It is not believed that this time can be materially reduced by piece work, and if these results are maintained there is little or no advantage, so far as this particular work is concerned, in either piece-work or the premium system. Two years ago 12 hours was taken to manufacture a bag, while a year ago it took eight hours, and this time has now been reduced to less than three hours. As the pay of sailmakers is 58 cents an hour, the saving effected is very large. Similar reductions have been made in other classes of manufacture work, and also in all repair work.

It is difficult to believe that such large reductions can be made in work of this character, but the records are vouched for, and the performances described can be duplicated at any time.

In the Machine Shop

In the machine shop by far the greater part of the work is repair work and comparisons showing the improvement cannot be made. In the manufacture of fittings such as hose valves, air ports, boat castings, deck-light fittings, etc., the costs were greatly reduced and in many cases were less than half previous costs. In the manufacture of steam winches, the cost was less than the cost of the same winches in Eastern yards. Not only did the better methods reduce the cost but they greatly reduced the time required to do work, and this is important in a navy yard which will be called on in time of war to make repairs to the fleet.

Workmen	First Records	Date, 3-5-10	Date, 4-6-10	Date, 5-10-10	Date, 5-16-10	Date, 5-2-10	Date, 6-15-10
1	390	190	...	180	180	171	132
2	390	210	195	188	180	174	156
3	390	220	214	188	180	180	156
4	390	225	210	206	180	177	...
5	390	240	206	...	180	180	132

Can These Results Be Obtained Elsewhere?

Perhaps the editor of the American Machinist considers that navy-yard shops are in the condition that obtained in commercial machine shops 30 years ago, which he has described as follows: "Compared with the same place today the machine shop of 30 years ago was a place for peaceful meditation and an abode of silence."

There is no doubt that the navy-yard shops are far behind the great majority of commercial shops; there is no doubt that great improvements can be made in the Government shops; but it must not be overlooked that a Government officer attempting improvement has to contend with restrictions which are not found in commercial shops. From my observation there are many commercial machine shops in which the application of the principles of scientific management will result in great improvement. On the Pacific Coast at least, the application of these principles will bring results even better than those obtained in the Government establishment at Mare Island.

Holden A. Evans,
Naval Constructor, United States Navy.
Seattle, Wash.

How Would You Perforate These Sheets?

Referring to the article on page 747, under the caption. "How Would You Perforate These Sheets," the correspondent has failed to state which side of the leaded sheet is presented to the face of the die. If the layer of lead is of appreciable thickness it seems to me essential to present the leaded side to the die.

The other cause of breakage of punches could possibly lie in the increased stretch of the metal while under the operation. I think with the proper arrangement of the tool the ⅛-inch punch ought to stand up on metal 0.065 inch thick.

Joseph Falk.
Salt Lake City, Utah.

Iron and steel can be protected in the following manner: After all the rust has been cleaned off by means of stiff wire brushes, a tacky paint is applied. Paraffined paper is then applied and tightly pressed against the surface, the joints of the paper slight overlapping. As soon as the paper is in place it is ready for the outside coat of paint.

Milling Cutters and Their Efficiency

By A. F. Murray

A discussion before the A. S. M. E., in Pittsburg, giving experience which points out the superiority of cutters having widely spaced teeth.

The results of Mr. DeLeeuw's experiments are in accordance with theories which I have been advocating for several years. We are continually recutting old milling cutters for our manufacturing departments and invariably reduce the number of teeth to about half the original number, setting the mill deep enough to cut out every other tooth completely. In most cases we have done this with the standard bevel cutters for milling the teeth. We are now very glad to avail ourselves of the results of Mr. DeLeeuw's experiments as to changes in these cutting angles for end and spiral mills.

We have an equipment of the high-power face mills, as shown by Mr. DeLeeuw, and we have recently had made for us some new high-duty 16- and 20-inch face mills for a heavy four-spindle miller. Fig. 5 of this discussion is a photograph showing the two 16-inch cutter heads at work with the two 20-inch cutter heads standing alongside of the machine. An old pattern 12-inch cutter head is shown on the rail spindle in this picture.

The method of attaching these cutters to the spindle is worth noting. The spindle has a taper hole in which is fitted a short arbor 3 inches in diameter, used only for centering the cutter. The spindle also has a flanged end 7 inches in diameter and a key ½x1 inch permanently dovetailed across its face. The flange is also tapped for four ¾-inch bolts which hold the cutter firmly and squarely against the face of the spindle but do not assist in driving as they go through clearance holes in the cutter head. This method of holding was suggested by one of the cutter manufacturers and adopted after careful trial of cutters screwed on to the end of the spindle and several arrangements with drawback bolts and both face and longitudinal keys. Fig. 2 shows the construction of these cutters. It will be noted that the bodies are shaped like the frustum of a cone with the blades pitched back at an angle of ten degrees and projecting beyond the rear of the body as much as the design permits. In this way long life of cutter blades is secured with a minimum amount of grinding. The other clearance angles it will be noted are practically the same as Fig. 16 of Mr. DeLeeuw's paper, on page 788. Instead of three settings in grinding required for cornering the blade there shown, we have obtained good results with two settings, as shown in detail in Fig. 2.

It is our intention to construct an experimental cutter with coarser pitch of blades (2½ and 3 inches instead of the 2⅛-inch) than those we have at present, as we do not believe we have reached the limit in the direction.

End Mills

Referring to Mr. DeLeeuw's remarks on end mills, results obtained in a splining machine recently put on the market, by the use of fish-tail cutters running at high speed with ample lubrication have served to indicate that a reduction in the number of teeth of end mills was desirable. We have recently put into use several 3- and 4-inch inserted-blade end mills with six and eight teeth respectively, the blades being constructed of ⅜x1 1/16-inch high-speed steel, raked in the same manner as the larger face mills shown in Fig. 16 of Mr. DeLeeuw's paper.

Saws, slotting and side mills, as ordinarily made, certainly have too many teeth. It is my opinion that a large proportion of the success obtained by the use of inserted tooth mills for this purpose has been due to the enforced reduction in the number of teeth.

Several years ago, while connected with a small arms factory, I assisted in some experiments which were made for increasing the production of a very heavy slotting operation in which a 7-inch cutter, 0.900 inch wide with a 1¼-inch hole, buried itself to the hub in a steel forging set at an angle of 45 degrees, as shown in Fig. 3. The operation was performed on a heavy type of Lincoln miller. The first cutter employed was a high-speed side mill of regular pattern. This cutter gave very unsatisfactory results and stalled the machine with light feed, choking with chips, although the cut was flushed with a heavy stream of soda water. Someone suggested the cutter shown in Fig. 4, and this practically doubled the production, but the output

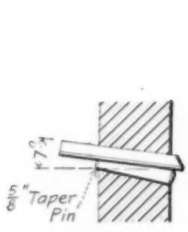
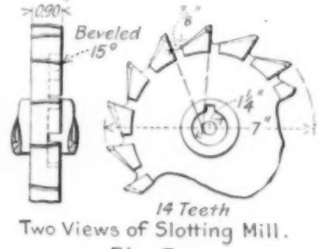
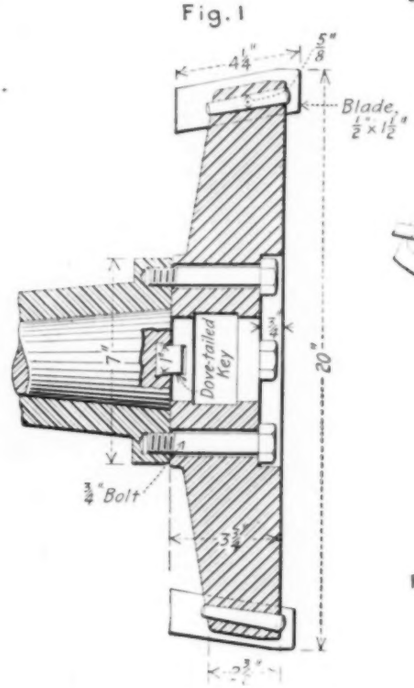


Fig. 2



Two Views of Slotting Mill. Fig. 3

Fig. 1



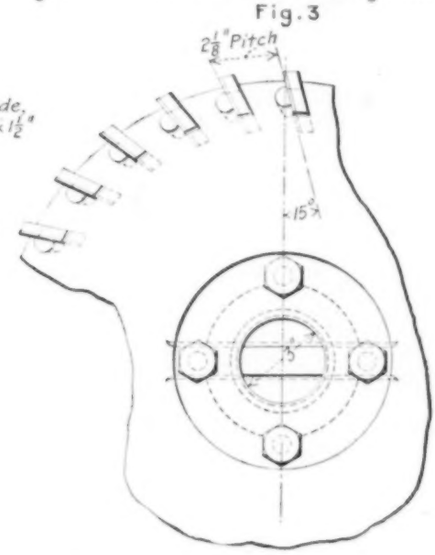


Fig. 4 Am. Mach.

Details of Inserted-tooth Milling Cutter

was still below requirements. Opposite corners of alternate teeth were then removed, as shown. This slight change enabled us to feed from 1 to 1¼ inches a minute as against about ⅝ inch with the cutter, Fig. 4, and about ⅜ inch with the standard form of side-milling cutter.

Inserted Tooth Side Mills

About two years ago I repeated this experiment with an inserted-tooth side-milling cutter 10 inches diameter, 1½-inch face, 2-inch hole. The pitch of the blades was about the same as that shown in Fig. 17 of Mr. DeLeeuw's paper (being a side mill the blades were set in parallel to the axis), approximately 1 inch circular pitch. This cutter was used as a slotting mill to mill a slot 3½ inches deep by 1¾ inches wide in United States Navy class A steel forging having a tensile strength of 80,000 pounds per square inch.

The cutter, as furnished by the cutter manufacturer for straddle-milling work, was unable to cut through this material more than ⅜ inch per minute and the machine could be heard all over the room. This job recalled the experience above referred to and alternate corners of the inserted blades were ground off at an angle of 15 degrees, 1/16 inch beyond the center and they were offset sufficiently so that the 1½-inch cutter was able to machine the 1¾-inch slot to size at only one cut. This change increased the feed possible from ⅜ up to 1⅛ inches per minute.

This slight change gave 200 per cent. increase in efficiency and was accomplished by making the chip three times as thick and half as wide as at first and providing additional chip clearance. It is believed that some of the side mills shown in Fig. 14, *A* and *B*, and Fig. 15 of Mr. DeLeeuw's paper would be improved by the adoption of this staggered tooth when used for cutting slots.

The practice above referred to has been used quite frequently in connection with small T-slotting cutters; but I have never seen it used on the larger types of slotting cutters, except as above referred to.

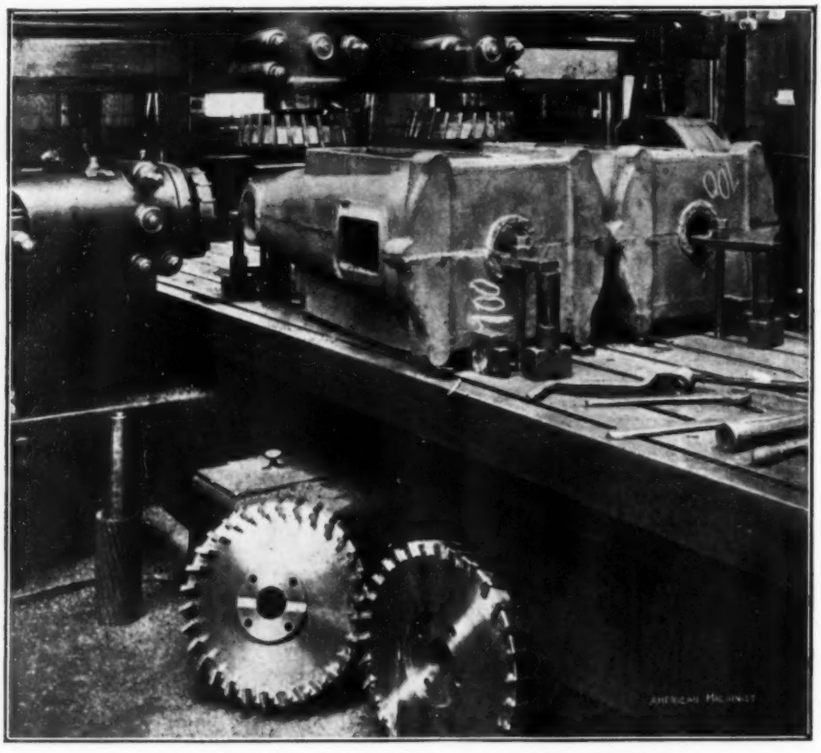


Fig. 5. How Teeth Are Inserted and Cutters Held

Quantity Manufacture of Small Devices*

By F. P. Cox†

The economical manufacture of small devices in large quantities is chiefly characterized by the attention which must be given to details. The cost of material is in general proportionally small, and in any case more or less fixed by the design; but the labor item is large and requires constant and careful scrutiny. Unlike other lines of manufacture, each operation is repeated over and over again and, therefore, warrants a considerable expenditure of time and money to determine exactly the best manner in which to perform it. It is desirable to know just how economically it can be performed even though temporary conditions prevent an immediate realization of possible results.

This leads to scientific rate setting, and the advantages of such an experimental manufacturing department are too well known to require comment. It means automatic machinery for many operations, but not for all; it means suitable provision for stock handling, inspection, supervision, etc. Each of these subjects, if covered completely, would require an individual paper. In addition, it requires organization to provide for the proper correlation of these various elements and to insure their harmonious operation.

Many plans of organization along the same general lines are possible. The general lines are subject to variations at times, but they are all centered around the same principal object, the labor item. No manager will ever be able fully to realize his ideal system, and perhaps the chief reason will be found in the limitations of his assistants. An organization which has been in operation for any length of time will have developed a certain number of individualities which must be reckoned with in any contemplated change. It would be folly to dispense with a man of proved value because he does not happen to fit exactly in an ideal plan of organization. It is always possible to modify the system to avoid such a sacrifice and without any material departure from the original scheme.

An equivalent system can be devised with comparatively little difficulty, but the equivalent of a tried man is hard to find. Of course, this does not mean that a weak man should be retained, nor that one not in sympathy with the plan of organization should be permitted to take part in its administration. Neither does it mean that any effort should be spared to find and employ a competent man to fill an important part in the general scheme. It does mean, however, that a man whose known limitations prevent him from filling all the duties of a certain position should have those duties so modified that he will not be prevented from filling those for which he has been found particularly adapted; and that one who has shown particular ability in handling two or more lines, not originally intended to be combined, may still exercise this talent by a reasonable modification of the system.

Outline of Organization

The organization here outlined probably differs very little from similar organizations intended to cover the same field.

Manager
- *a* Superintendent
  - (1) Production clerk
  - (2) Stock clerk
  - (3) Material-list department

*Paper presented to the American Society of Mechanical Engineers.

†Meter department, General Electric Company.

(4) Rate-setting department
(5) Automatic-tool department
(6) Shop accountants
(7) General foreman
(8) Inspectors
(9) Tool department

b Engineer
(1) Designer
(2) Draftsmen
(3) Model room

c Cost department

The strength of this organization lies in the fact that each feature of manufacture is under control of a man particularly qualified to handle it in the best possible manner, and that his responsibility is definitely fixed and limited to the proper performance of his own part of the work. There is no overlapping of responsibility and no possibility of misunderstanding. Any failure to produce a part is at once traced to the responsible party. For example, if a leading hand finds that he is not receiving his parts in adequate numbers and is, consequently, handicapped, he at once reports to the stock clerk who has failed in his duty. The stock clerk realizes that he has failed. The mere absence of parts is convincing evidence of the fact, and he must correct the shortage before it becomes a limiting feature or report his inability to do so to the superintendent.

In this way, the superintendent is constantly advised of matters which are liable to interfere with his business, and is able to apply corrective measures before the situation is serious.

When everything is moving properly, if such condition should ever exist, the work of the various departments becomes routine, but the moment any trouble appears in the distance, an alarm is sounded. If trivial in character, it is corrected without any great disturbance, but if important, it comes at once to the highest authority and the whole strength of the organization is applied promptly to correct it.

The functions of the different departments are, in general, sufficiently described by their names. It may be necessary to add that all material is ordered by the material-list department, but the following of the stock into and through the shop rests with the stock clerks, and that while the inspectors come under the superintendent, the limits of inspection are set by the engineers.

The workman is the principal subject of study and every effort must be made to shorten the time and lessen the effort required to perform the operation for which he is engaged. It may mean automatic tools, increased facilities, improved methods, or the splitting of the operation so that a portion of it may be done by a less skilled operator, who is competent to do this portion in a satisfactory manner.

Always inspection is involved in order that no time may be spent on a piece which is already defective and will ultimately be rejected or require special fitting, which is necessarily expensive. The proper time to reject a piece or to correct it is immediately after the false operation has been completed.

In order that a workman may perform a maximum of work with a minimum of effort, it is necessary that the piece shall come to him in ample quantity and at a constant rate; that previous operations shall have been properly performed, and that the piece shall be promptly inspected and removed. His whole thought and effort should be given to performing his own operation satisfactorily. One portion of this desired result may be obtained by a large stock of parts, but this means unnecessarily large inventory, and should be rejected. It is just as necessary that parts should not wait for the workman as it is that the workman should not wait for parts.

Regular and frequent meetings are held by the superintendent and his assistants, so that each may be familiar in a general way with conditions as a whole, but such meetings are not to be construed as lessening the responsibility of the different departments. These meetings require but little time if everything is going smoothly, and justify the time taken if there is any prospect of trouble.

Similar meetings are held weekly by the manager, engineer and superintendent, and are more or less generally attended by principal assistants. Change of design or method are freely discussed at these meetings, and they serve as a clearing house for all matters of interest which have come up during the week and which are not of sufficient importance to require instant attention.

Changes of design, unless to correct defects in the apparatus are docketed and not acted on singly as they arise. Low costs cannot be obtained where the design is continually changing, and minor changes should be held for an apparatus meeting. Such meetings are held at regular intervals of from three to six months. When a line of apparatus has but recently been placed in the shop, the interval is shorter than when it has become more firmly established and original troubles eradicated.

Apparatus Meetings

Apparatus meetings are attended by the manager, engineer, cost department and superintendent, with their assistants who have the actual handling of the apparatus. The device is placed on the table and gradually dissected, each part being fully discussed as it is taken off, and the presence of the leading hand is considered essential during the discussion of the particular part or operation with which he is concerned. The leading-hand, or gang boss, comes under the general foreman. He has direct charge of a rather small number of operators, and often a portion of his time is given to productive labor. More than anyone else he appreciates inconveniences and difficulties which arise in producing his particular part, and any organization which fails to profit by such knowledge is fundamentally defective. Introduction of automatic tools, change of methods or of design, and quality of product are thoroughly gone into and after this meeting all changes decided upon are authorized at one time after which none are made until the next change period.

Hobs with Inserted Blades

By Edward J. Rantsch*

Having several small bronze worm gears to hob, I was puzzled as to the best manner of making hobs quickly and economically, the gears being required immediately and the job not warranting having an expensive hob. I finally decided to make the hobs as shown in the line cuts.

Fig. 1 shows a cast-iron body in which are cut four slots. Four tool-steel blades are fitted in these slots and pinned in place. The blank diameter is then turned in lathe, allowing about 0.010 inch to 0.015 inch for grinding. The grinding operation is a great advantage as this overcomes the breaking off of the edge, along the blade, when completely turned in lathe.

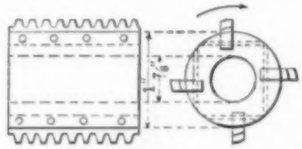


Fig. 1

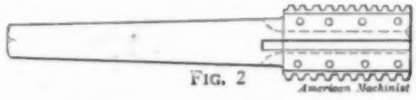


Fig. 2

Hobo with Inserted Blades

The thread was then milled on a Pratt & Whitney thread miller, after which it was backed off with the file. After backing off the threads in the hob, it was hardened with blades pinned in position, and then ground on cutting edges.

Fig. 2 is a hob made in a similar manner, except that it was made with a taper shank instead of hole as in Fig. 1. While there were only four blades in each, they worked well.

Those who enjoy keen satire, will do well to send for a copy of the latest of the Revised Statesmen series on Captain John Smith., by Pres. F. W. Haskell, of the Carborundum Company, Niagara Falls, N. Y., and will be sent on request.

*Department foreman, E. W. Bliss Company, Brooklyn, N. Y.

Two New Springfield Grinders

The Springfield Manufacturing Company, Bridgeport, Conn., have two new grinders which are of considerable importance to those interested in heavy grinding. One is a car-wheel grinder and the other is what is cataloged as a rotary and oscillating surface grinder, and is illustrated in Fig. 1.

This machine is an improved and new design, and as shown, is made with both a horizontal and vertical grinding head, the vertical head being mounted on a swivel and provision made to grind both straight and angular work up to 45 degrees with a vertical travel of 12 inches. Both the horizontal and vertical heads are provided with micrometer dials to facilitate the sizing of work, and have automatic reverse. The little swinging bracket shown on top of the wheel head for horizontal grinding, which carries the micrometer dial, is very easily swung in and out of position, so as to engage or disengage with the worm under the shifting lever which operates the belt.

All power is transmitted through belts, with the exception of the vertical grinding spindle, which is driven by a direct-connected 1-horsepower motor. Suitable provision is made for raising and lowering the cross rail by means of reversing belts, as shown on the top rail, operated by means of a lever on the side of the housing.

Throughout the machine ample provision is made for lubricating the bearings,

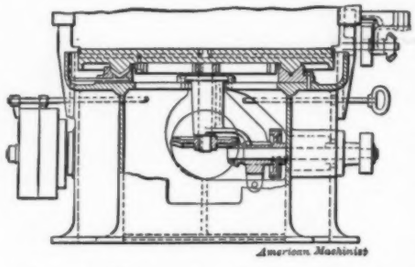


FIG. 3. METHOD OF DRIVING TABLE

4, the bed being much heavier and the wheel heads of entirely new design, arranged so that the operator can stand between them and manipulate both from the same position. These wheel heads are of heavy box section and the spindle bearings are of bronze, split and tapered on the outside and held in place by screw collars which also serve as a means of adjustment. The spindle drive is provided with a two-step cone and the wheel is mounted on the end of the spindle, which facilitates the changing or replacing of wheels. Strong, substantial wheel guards prevent spray and also protect the operator against broken wheels. The bed is used as an overflow and settling tank, the pump taking its supply from the overflow tank and supplying sufficient water for both wheels. The overhead works are carried on two substantial columns securely fastened to the bed, and the whole driven by a motor of not less than 20 horsepower. The wheels to be ground are carried upon the centers in their respective shafts and are driven

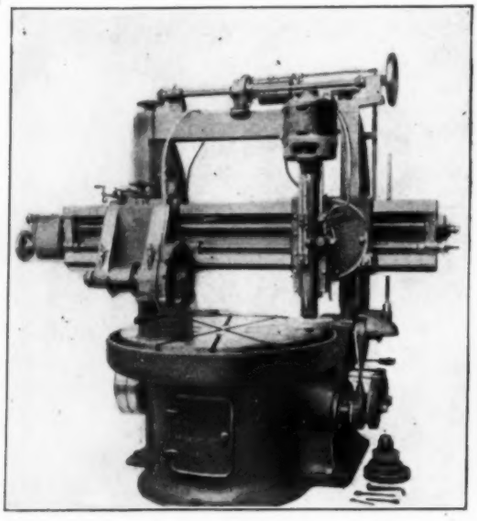


FIG. 1 ROTARY AND HORIZONTAL OSCILLATING SURFACE GRINDER

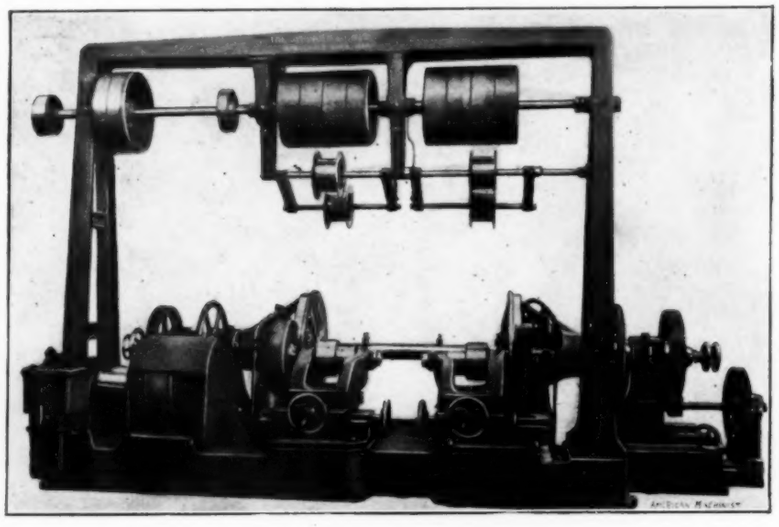


FIG. 2

wheel, and when so engaged the small crank is used for fine adjustment, and when disengaged the hand wheel is used.

The ball handle shown on the vertical head is for convenience in reversing the direction of the slide by hand, and is locked by a sliding pin to prevent its accidentally engaging with the reverse clutches. The automatic tripping on both heads is accomplished by means of dogs and spring plungers which operate against a spring of sufficient tension to throw the clutches from one to the other, positively and accurately. The table drive is through spur and bevel gears direct connected to the under side of the table by means of an internal gear and pinion, as shown in Fig. 3. This method of driving through spur gears permits the changing of speed for various diameters, which is accomplished by means of change gears shown on the right, directly and sight-feed oilers are provided for oiling the main bearings and felt oilers are used on the V-bearings of the table. The machine has a pump which takes its supply from a large overflow tank which is provided with a settling tank, thus preventing, as far as possible, the entering of any foreign substance into the pump.

The table is 45 inches in diameter and work as large as the table and 20 inches high may be ground. The horizontal wheel is 16x2 and the vertical one 10x1 inches, and are to run 1100 and 1500 revolutions per minute, respectively. The vertical movement is 12 inches; the machine occupies a floor space of 6x9 ft. and weighs 10,000 pounds.

CAR-WHEEL GRINDER

The machine shown in Fig. 2, is an improved form of their old standard No. by means of three arms which are forced against the rim by means of the large handwheel shown, the driving dogs being adjustable for various sized wheels.

This machine will grind wheels up to 43 inches; carries 18x2½-inch grinding wheels, has two grinding-wheel speeds, 1000 and 1280 revolutions per minute, and weighs 17,000 pounds.

It is said that the following preparation will keep machinery clean for months under ordinary circumstances, as, for instance, in a show room: One ounce of camphor, dissolve it in one pound of melted lard and add enough plumbago powder to make the mixture the color of iron. Clean the machinery and smear it with the mixture. After it has stood for 24 hours rub the work clean with a soft linen cloth. This is said to absolutely prevent rust.

Issued Weekly by the

Hill Publishing Company

JOHN A. HILL, Pres. and Treas. ROB'T MCKEAN, Sec'y.

505 Pearl Street, New York.

Correspondence on mechanical subjects solicited and paid for. Name and address must always be given—not necessarily for publication.

Subscribers can have address changed at will. Give old and new addresses.

Subscription price $4 per year, postage prepaid, to any post office in United States, United States possessions and Mexico. $5.50 to Canada. $7 in all foreign countries except Europe and British possessions in Eastern Hemisphere.

Hill Publishing Co., Ltd., 6 Bouverie St., London, E.C., will serve all subscriptions for English Edition for Europe and British possessions in Eastern Hemisphere. Price 30 Shillings for England. For all other countries in Eastern Hemisphere, 35 Shillings.

Published in the German language under the name of "Maschinenbau," by the Hill Publishing Co., A. G., 71 Unter den Linden, Berlin, N. W. 7. Price for Germany 24 M., Austria 29 K., Switzerland 32 Fr., other countries in Eastern Hemisphere 35 M., North or South America 40 M., or $10.

Entered at New York Post Office as mail matter of the second class.

Cable Address, "MACHINIST," N. Y.

CIRCULATION STATEMENT

During 1910, 1,488,400 *copies. For May,* 1911 *(American weekly, American monthly, English weekly and German weekly), total,* 108,750.

Of this issue 24,000.

None sent free regularly, no returns from news companies, no back numbers.

Contents

PAGE

Methods of Motor Construction..... 1103
An Indicator for Use in the Miller..... 1107
Report of A. S. M. E. Committee on Identification of Power House Piping.. 1108
Drilling Fifty-four Holes at Once..... 1109
Nurling in the Drop Press..... 1110
Manganese and Silicon in Foundry..... 1111
Need of a Gage for Surface Finishing.. 1113
Handling Heavy Work in the Shop.... 1114
Pointers for Designers of Cranes..... 1117
Two Special Slide Rules..... 1118
A Convenient Spiral Planing Device... 1120
Tools in Computing Scale Plant..... 1121
A Compact Blueprint Room..... 1125
Dressing Surface Grinder Wheels..... 1125
A Tool Room Index for Laying Off Angles 1126
Letters from Practical Men:
A Turret for the Engine Lathe.... A Vertical Milling Attachment for the Slotter....Pattern Making Kink ....Creaser for Lettering Guide ....An Ingenious Drilling Device Drawing Brass Shells....Arbor for Turning Armatures....Method of Testing T-Squares to Angles....A Vertical Feed for Planer Extension Head .... A Homemade Relieving Attachment .... Improvised Bubble Fountain .... A Slotter Tool Bar 1127-1130
Discussion of Previous Question:
Efficient Record and Route System ....Machinery Bearings .... Turning Spokes Round at One End and Oval at the Other....Testing Automobile Valve Springs....Responsibility for Good Work....Chuck for Splining Spindles....Do Taylor's Methods Increase Production?.... How Would You Perforate These Sheets? 1131-1134
Preventing and Controlling Fires..... 1135
A Waste of Money to Buyers of Machine Tools 1135
Two New Springfield Grinders..... 1138
Shop Equipment News..... 1141

American Machinist

Preventing and Controlling Fires

The recent fires which have occurred in various industries show several things very clearly.

That many of the fires are caused by an uncontrolled and reckless use of fire in the shape of machines, cigars or cigarettes, by which a few, in the exercise of what they are pleased to call their individual rights, endanger the lives of many who must work with them.

That fire escapes as ordinarily constructed are a delusion both in construction, and from the fact that they are often inaccessible, unsafe for women and that there is no systematic method of acquainting the workers with their location and use.

That inflammable materials are allowed to accumulate in highly dangerous quantities; that work shops of too many kinds are crowded beyond the safety point and that in too many cases, emergency exits are locked or are unknown to the workers.

But, even with all these things as they should be, there still remains the grave doubt as to the possibility of escape after a fire once starts in inflammable material unless it can be checked almost instantly, as can be done with any good system of automatic sprinklers.

While these should not be allowed to induce carelessness as to matches, cigarettes, fire escapes or a thorough knowledge of exits, the low rates given by insurance companies where they are installed gives conclusive evidence of their ability to control fires before they become dangerous to life or property. When of a proper design and correctly installed, they form a silent fire department that is always ready for the still alarm.

The lingering fear of water damage by accidental opening can be set aside when it is known that the insurance companies now include insurance against water damage without extra charge, providing an approved type of sprinkler head is used in connection with proper piping. No greater tribute to their reliability could be found.

While machine shops are comparatively free from fires which endanger life, the installation of a sprinkler system will prove a paying investment. Such installation should be compulsory in all loft and factory buildings which are liable to be used for a variety of manufacturing, as it would safeguard both life and property in the best manner we know of today.

Pattern and wood-working shops certainly require such protection and until a better system is found, the sprinkler system should be a part of every building code.

And there is much to be done in bringing to every individual, no matter what his or her position, a full realization of the responsibility in the handling of matches, benzine, cigars or other dangerous materials.

A Waste of Money to Buyers of Machine Tools

Why do builders of machine tools expend from twenty-five to fifty dollars' worth of labor and material in painting a machine in such a manner that after a few months' service in the average shop it will present possibly a poorer appearance than if only one-tenth of the effort and expense had been devoted to the filling and painting process?

At present the customary procedure in finishing a machine base, say a lathe bed, or the column of a milling machine or grinder, is to clean the rough casting as it arrives from the foundry, rub it down with emery bricks or similar materials, apply a coat of paint and fill the surface, then rub down again and put on a second coat of paint. After the machine is erected the surface of the bed is gone over again and filled in wherever the original filler has been knocked off during the various handlings about the shop, and eventually a finishing coat of paint is applied.

As a result of all of this attention the tool as it leaves the shop of its builder certainly looks very neat, no matter how rough the principal casting may have been when it emerged from the foundry; but after a brief period of usage in the plant of the purchaser, during which time the nicely painted surfaces are subjected to deluges of oil of all kinds, soda water and other lubricating mixtures, the former attractive appearance disappears, and this disfigurement is aggravated by the fact that occasional knocks and blows incidental to shop practice, cause the paint and filler to flake and scale off in spots larger or smaller as the case may be. As a result, the machine looks no better, and perhaps even less attractive than if at the outset it had been merely rubbed down and given a couple of coats of dull paint.

This practice has in fact just been proposed by the manager of one of the largest and most prominent of machine-tool firms. In a recent conversation he called

attention to the folly of the present custom and stated that it cost his firm no less than $45 to fill and paint a certain machine of which their output runs into the hundreds annually. This tool happens to be one which in operation is flooded with soda water and the entire effect produced by the expensive method of painting is destroyed almost immediately in service. Its case is typical of a number of standard machines and in some degree of nearly all machine tools as operated under modern conditions.

The experience of this practical manager and of others whose attention he has drawn to the matter, is that the logical treatment of the rough machine bed is as follows: Rub down, apply two coats of dull paint, and use no filler. This, of course, means that with the filling process eliminated the casting must be a good specimen of the molder's art and aside from the economy effected in painting, the modification suggested if generally adopted could not help but lead to the production of better foundry work consequent upon the demand for smoother castings in the machine shop. In any event the machine's appearance after a service of some few months would be equally good or even better than is now the case with a large proportion of tools operated under the conditions referred to above.

The actual saving which might be effected in labor and material costs in the painting process would range it is estimated from 50 to 75 per cent. of the present outlay in that direction. When this runs from say $25 to $50, it is no inconsiderable item, and in so far as unnecessary outlay in this direction is of no advantage either to builder or purchaser of tools, the sum whatever it may be, should be saved to the buyer in the charge for the machine, or an additional and equivalent amount of labor or material might be put into the construction of the machine at such points as would be of real benefit to the user, without increase of cost to him.

Standard Colors for Piping

In another column we print the report of the American Society of Mechanical Engineers' committee on identification of power-house piping. This is a color scheme, by means of which either the pipe or its flanges or fitting flanges are painted distinguishing colors.

The usefulness of the scheme will appeal to anyone who has tried to trace out a gas or water or air pipe from floor to floor and room to room, and then cut into it only to find it other than the one wanted.

However, if there is any desire to have even reasonable uniformity in regard to color and shade, the committee will need sample-color cards made, otherwise one man's buff may not have even a distant family resemblance to that of his neighbor's. The difficulty of standardizing colors for painting machinery has demonstrated this time and again. Some shops have color samples painted on sheet-steel and arranged according to a system of limits; that is, a limiting light and dark shade for each standard color. The painter must get in between to have his work pass.

New Publications

THE AEROPLANE. By C. O. Hubbard, L. H. Ledeboer and C. C. Turner. One hundred and twenty-seven 5x7½-inch pages with 39 illustrations. Longmans, Green & Co., London and New York.

This volume is well described by its subtitle as "an elementary textbook of the principles of dynamic flight." It gives in clear and concise language the basic principles of aëroplane construction, including such laws of the action of the air on aëroplane surfaces, of the shapes and sizes of the surfaces, of gliding, stability, proportions, propulsion and power required as are known. The book is a serious and straightforward attempt to place before the reader the basic principles of aëroplane design and construction, and it may be confidently recommended.

THE ENGINEERING INDEX ANNUAL FOR 1910. 496, 6½x9-in. pages. The Engineering Magazine, New York and London. Price $2.

We are always glad to announce the appearance of the invaluable annual instalment of the engineering index, which is conducted with so much enterprise and painstaking care by the *Engineering Magazine*. No extended description is necessary, as our readers are familiar with the enterprise, which in its various volumes now supplies a continuous index to the periodical engineering literature of the past 26 years. The entire enterprise represents a service to the engineering profession which deserves recognition and patronage by all. The volume is in itself an illustration of the value of technical journalism, as the labor and cost involved could not, we presume, be even contemplated if the index were, in the first instance, published other than as it is, as part of a technical magazine.

MATHEMATICS FOR PRACTICAL MEN. By George Howe. One hundred and forty-three 4½x7¾-inch pages; 42 illustrations in the text; tables of logarithms and natural functions of angles. The D. Van Nostrand Company, New York City. Price, $1.25. Reviewed by E. H. Fish.

This book is intended as a general work on mathematics above arithmetic, and was written to cover the needs of the author in his work with evening classes in engineering. It aims to begin at the beginning, to go forward in a scientific way and to meet the every-day needs of the engineer in mathematics.

That there is a real demand for a book of this nature is certain and that there is as much need for such a book by college graduates, who wish to hastily review their mathematics as by beginners seems likely. It would also seem that this book appeals more to those who wish it for review than to beginners for the reason that the latter will find successive steps in the book too high to surmount without other help. When we remember that the whole of algebra, geometry, trigonometry, logarithms, coördinate geometry (analytical) and calculus, which apply to the more usual needs of the engineer are here condensed in a hundred pages net, it is evident that some of the strides must be long and high.

Nearly half the book is taken up with algebra, and while this in the main is well treated, and the steps are more moderate than in other parts, the persistent illustration of processes by the substitution of letters for things instead of quantities is likely to mislead the uninitiated. For example, the author represents a table by a and a chair by b, and multiplies them together and produces $a\,b$, but fails to say what the product looks like in terms of tables and chairs. This illustration becomes still more confusing when one attempts to conceive of $a\,b$ or $(a—b)^3$ in the same terms.

The examples given are abstract with the exception of a few old problems. It would seem that mathematics is sufficiently used in engineering work to afford a few concrete problems for a work of this kind and leave the compiling of inventories from impossible conditions, by algebra, to the professional writer of text books.

Personals

Edwin H. White, formerly sales manager for Nelson Goodyear, has established an office at 154 Nassau street, New York, to give sales-promotion service to those whose products require it.

E. G. Schmeisser, formerly assistant engineer in the department of electric traction of the Pennsylvania Railroad Company, has been elected second vice-president of the Wiener Machinery Company, of New York.

Frank G. Payson, who has been connected with the Niles-Bement-Pond Company, New York City, for the past six years, will end his connection with that company July 1, and during the summer will be located at Phenix, R. I.

E. E. Minard, who has been connected during the past seven years with the mechanical department of the Western Electric Company, Chicago, Ill., recently resigned as chief tool designer in order to become superintendent of the National Coil Company, Lansing, Mich.

Shop Equipment News

ANY and all new or improved machines, tools or shop appliances of interest to men responsible for results in machinery-making plants will be briefly illustrated and described here — the machine shop news.
A more full and detailed description will be given — when it is real news — if it can appear here first — before it is sent to other papers. ALL descriptions appear in ALL four editions of the paper—Weekly, Monthly, Weekly English and Weekly German

Landis Attachment for Grinding Integral Cams

This attachment has been designed especially for grinding cams in place on their shaft, both made from the solid forging and of the built-up type or detachable construction.

It is constructed on the swinging principle, the main table is suspended from bearings supported at the ends. The work is held between centers, the footstock being adjustable along the table for different lengths.

A special master, as shown in Fig. 1 at *A*, is furnished with each attachment and is copied direct from the cams of a model shaft which is fitted in the place of the master for this operation.

The master cam is made from solid steel, thereby eliminating any chance of the cams becoming loosened from the shaft, which would affect timing. It operates in contact with a roller *B*, Fig. 1, which gives the swinging motion to the table as the master revolves for forming and reproducing the cam shapes on the work. Both the master cam and roller are hardened, assuring durability and continued maintenance of the master cam's form.

When grinding, the roller is in contact with the cam of the master corresponding to the one being ground, and shifted along the table of the machine as the wheel is moved from cam to cam on the work.

When shifting the roller, the table is swung away from the wheel by pulling down the upright lever *C* at the end, which disengages the master cam and swings the table so that the master cam will clear the roller when it is shifted.

The size of the roller corresponds to the size of the grinding wheel, which is used in grinding the master cam and is located in the same relation to the master cam as the grinding wheel is to the work. Fig. 2 shows an end view with shaft in position.

This attachment is used on the universal and plain grinders of 12- and 16-inch swing built by the Landis Tool Company, Waynesboro, Penn., and applied by simply clamping it to the table of the machine, requiring no alteration in the machine itself, except the removal of the headstock and footstock. In addition to the centers for carrying the work, it is supported by adjustable steady rests of the shaft between the cams, having detachable jaws, which can be changed for the different sizes of shafts.

Provision is made in the work-driving fixture for "timing" so that the cams will be ground in proper relation to the keyway or flange. For driving, the pulley at the end is belted to the countershaft of the machine.

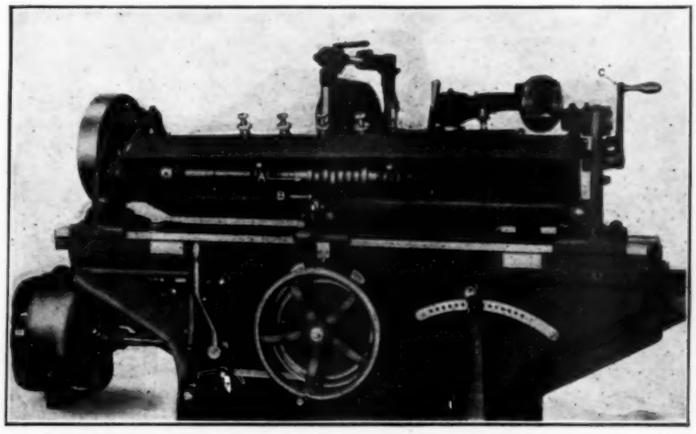


FIG. 1. FRONT VIEW OF CAM-GRINDING ATTACHMENT

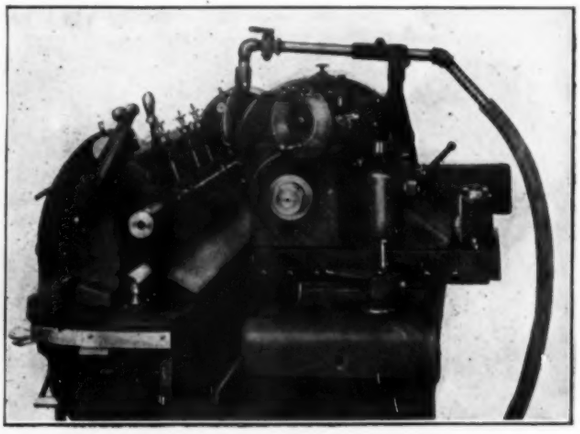
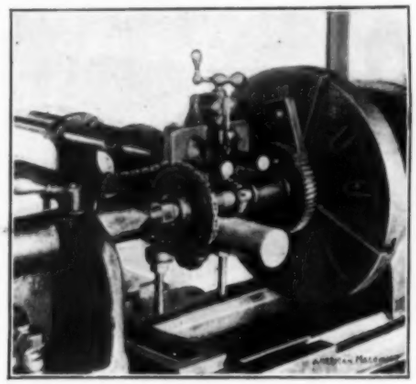


FIG. 2. END VIEW, SHOWING SHAFT IN POSITION

Portable Shaft Keyseater Used in Lathe

The illustration shows an interesting application of a portable shaft keyseater. The operation of the machine is exactly the same as when used as a portable tool, except that the hand crank, pinion and pinion-stud are removed and the keyseater placed between centers, as shown, on any engine lathe having a backing belt. A driver is fastened to the lathe faceplate in such a way that a projection therefrom can be inserted between the arms of the spur gear of the keyseater.

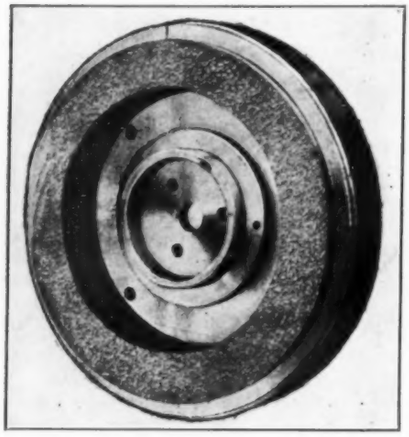


MILLING KEYSEATS IN THE LATHE

The keyseater shown is manufactured by John T. Burr & Son, 429 Kent avenue, Brooklyn, N. Y.

Pressed Steel Ring Wheel Chuck

The accompanying halftone shows a chuck recently developed by Charles H. Besly & Co., Chicago, Ill., for holding cylinder or ring form of grinding wheels, in the various forms of grinders, especially adapted for roughing off excess scale and rugged work. This chuck is also made with a hub bored for use on an ordinary emery-wheel arbor.



PRESSED-STEEL RING WHEEL CHUCK

Their construction insures safety in operation. The spindle bearing projects into the chuck thereby obtaining minimum overhang. The makers furnish these chucks, marketed under the name of "helmet" for holding ring wheels 10 inches, 12 inches, 14 inches, 15 inches, 24 inches and 30 inches diameter.

Motor Driven Pillar Shaper

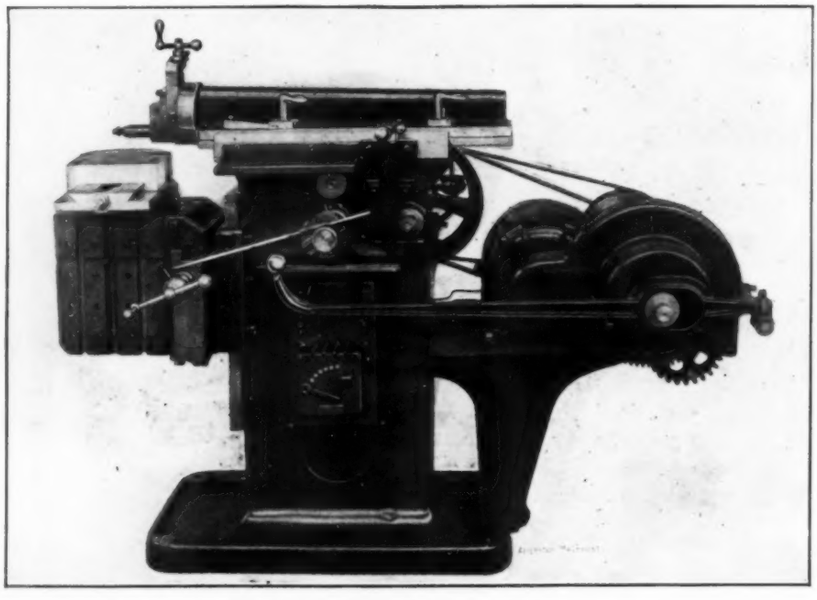
The accompanying halftone shows a Hendey pillar shaper equipped with motor for which it is particularly adapted, due to the fact that they are strictly spur-gear driven machines running at a uniform rate of speed for any length of stroke, whether it be the shortest or maximum length of travel.

The casting on which motor is mounted consists of a bracket with suitable platform bolted to shaper base at the rear. This bracket rides on the flange of base and by means of suitable bolts and setscrews it can be rocked to and from the base to secure proper belt tension on pulleys. Cast integral with this bracket are two sets of housings with babbitt linings in which run two back-gear shafts. The lower shaft is spur-gear driven from upper shaft and as it rotates in the opposite direction it allows reversing as well as driving belt to run open.

A rawhide pinion on armature shaft engages with large spur gear running free on upper back-gear shaft. This spur gear has a hub extension which is fitted with Hendey countershaft type of friction-clutch drive, by which it engages the shaft. The clutch spool or wedge is operated by long lever pivoted to stud on side of gear casing and carried well to the front of machine at right-hand side. It will be seen that this friction drive enables the operator to start or stop shaper with motor running and allows quick control and an easy method of bringing the tool to any position over table. At the same time the forward position of lever makes it possible for operator to control all working movements without changing his position from the front side.

Motors can be furnished for either direct or alternating current but are constant speed in all cases.

This equipment was recently developed by the Hendey Machine Company, Torrington, Conn.



MOTOR-DRIVEN PILLAR SHAPER

Hand Keyseater

The accompanying halftones show a portable hand-operated keyseater recently placed on the market by F. L. Schmidt, Eleventh avenue and Twenty-first street, New York City.

The machine is rigidly constructed and will cut a keyseat up to 8 inches long

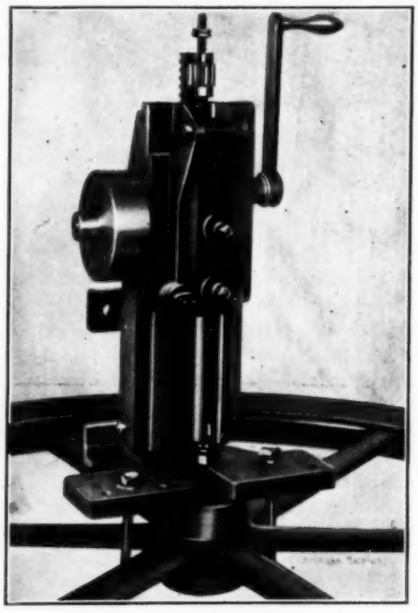


FIG. 1. KEYSEATER IN VERTICAL POSITION ON HEAVY WORK

and ½ inch wide. It can be used either horizontally or vertically, as is shown.

The handle shown operates the cutter bar. The feeding is accomplished by turning the large fluted nut at the end of the rack bar. There is an adjustment provided, so that the keyseat may be drafted either way. There are check nuts on the end of the feed screw to insure uniform depth when making more than one keyway. On the return stroke the tool is automatically lifted, thus reducing wear. The handle can be set for more or less leverage, according to the kind of work or size of keyseat.

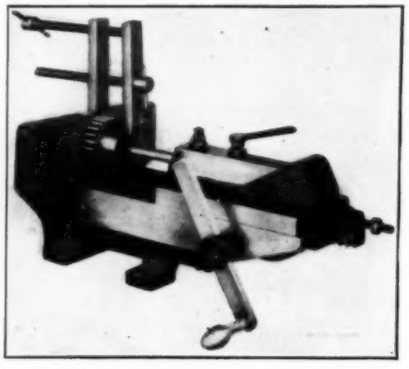


FIG. 2. USED HORIZONTALLY WITH WORK HELD BY CLAMP

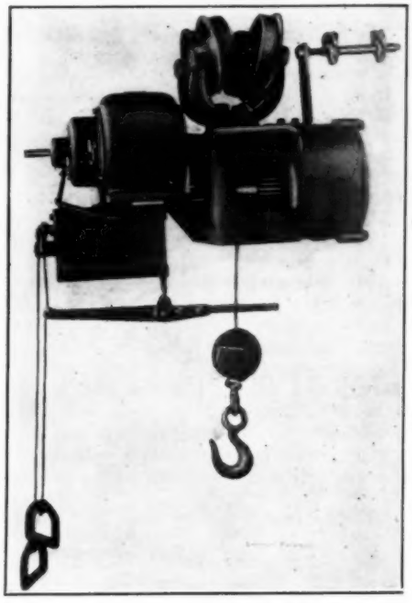
The machine weighs complete 86

pounds, and has keyseated cast iron ½x ¼ inch deep, 4 inches long in 15 minutes, and has been used successfully on a machine steel pinion 8 inches, 1 15/16-inch hole, 7/16-inch keyway 3/16 inch deep.

Electric Hoist

The halftone herewith shows a new electric hoist recently placed on the market by the Euclid Crane and Hoist Company, Euclid, Ohio.

The mechanism of the hoist consists of the hoisting drum, which is scored to fit the cable and has sufficient surface to prevent over-winding; three reductions



ELECTRIC HOIST

of spur gears and the load brake. The first two reductions of gears and the brake run in oil in an oil-tight casing, and although inclosed are easily accessible so that they can be removed and replaced in from 20 to 30 minutes, depending on the size of the hoist. All of the hoists have gears with machine-cut teeth and on all of the hoists, except the 1000-pound capacity, the gears are made from steel castings and the pinions from high-carbon steel.

The brake is a modification of the Weston disk brake. All of the high-speed mechanism runs in a bath of oil and all of the other bearings are supplied with grease cups.

The bearings are lined with replaceable phosphor-bronze bushings. The hook, which is made of drop-forged steel, swivels on a ball bearing. An effective limit attachment is furnished to prevent the bottom block from going too high through carelessness. The controllers are furnished with or without resistance, have renewable contacts throughout and the resistance is put up in separate units, which can be removed and replaced without disturbing the connections.

The motor used is of the Crocker-Wheeler type.

Surface Grinder

The surface grinder shown herewith is designed for manufacturers using dies for presses, stamps, and other work.

The bearings are split bronze sleeves, adjustable, ⅛ inch diameter, dust proof and self-lubricating. The surface table is adjustable, on the under side of which is cast a shank which is raised and lowered for minute adjustment by means of a screw bronze nut and handwheel shown. It is provided with a check nut to take up wear so that it cannot work down when under cut. The table is also adjustable up and down to any position on the column, and counterweighted.

The surface table is 8x15 inches, the machine is 3 feet 4 inches high, driving pulley is 4 inches with 3-inch face, and the spindle takes emery wheels 8 inches in diameter, maximum thickness 1¼ inches with ¼-inch hole.

SURFACE GRINDER

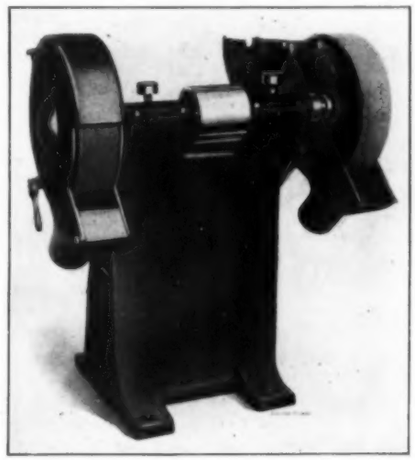
The machine is manufactured by the C. G. Carrigus Machine Company, Bristol, Conn.

Polishing Stand

This stand is of exceptionally heavy construction for this class of machinery. The bearings are extra long and are lubricated with compression grease cups.

Wheels are made of cast iron in two sizes, 14 inches diameter by 3 inches face and 16 inches by 3½ inches face. An abrasive cloth band of respective size is stretched around the wheel over a backing of felt. A device is provided for a constant tension on the abrasive band keeping it stretched tight from the time the band is put on till worn out.

The wheels are fully inclosed by dust hood when in operation, presenting only a small working portion. The top half way may be thrown back and the entire hood, which is mounted on a slide, may be dropped below the bottom of the wheel, the exhaust pipe telescoping inside the hood. This is done when it is desired to remove the wheel. Opening for exhaust connection is in tangent line to the working surface of the wheel so that in polishing long work the piece may extend down into this and the position of the



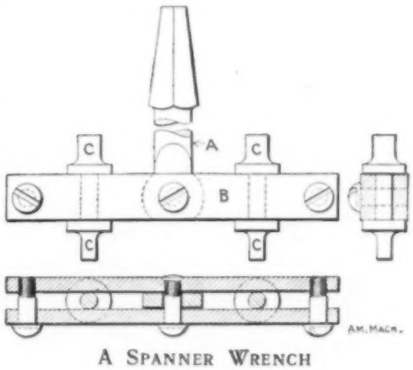
POLISHING AND BUFFING WHEEL

dust hood does not have to be changed.

This machine is built by the Gardner Machine Company, Beloit, Wis.

A Spanner Wrench

The line cut shows a tool, to be used in connection with an ordinary brace, for grinding in the valves of gas and gaso-



A SPANNER WRENCH

lene engines, or for other work to which a wrench of this character is usually put. The shank *A* is of any desired length. One end of it is squared as shown, while the other end is pivoted in the swinging yoke *B* which carries the adjustable driving pins *C*. These driving pins enter the holes usually provided in gas-engine valves for the purpose of grinding them in their seats. This tool is made by R. L. Hoffman, 20 Halliday street, Oil City, Penn.

Increasing Shop Capacities

News items for the sales department — where more equipment will be needed. Authentic news is solicited for this department, not rumors or gossip — facts

METAL WORKING

NEW ENGLAND

The Bridgeport (Conn.) Screw Company is figuring plans for a new manufacturing plant.

The Stamford Motorcycle Company, Stamford, Conn., has been incorporated to manufacture motorcycles. Capital, $10,000. Incorporators, Wm. F. Peebles, N. R. Wilcox, etc.

MIDDLE STATES

A large garage is being erected for L. E. Holden, Cleveland, Ohio.

The Steroga Paper Company, Little Falls, N. Y., will erect a new mill.

The Dudley Tool Company, Menominee, Mich., will erect a new factory.

The Hoquiam (Wash.) Steel Boiler Works has secured a site for its new plant.

The Dayton (O.) Acetylene Generator Company will erect an addition to its plant.

The Hydraulic Pressed Steel Company, of Cleveland, Ohio, will erect a $7000 garage.

T. B. Meehan is having a garage erected at 111 East Gorgas lane, Philadelphia, Penn.

S. T. Banham is having a garage erected at Carson and Main streets, Philadelphia, Penn.

B. Plummer is having a garage erected at 1319 South Broad street, Philadelphia, Penn.

The Peck Wheel Company, of Chicago, Ill., will install modern machinery for automobile work.

The B. E. F. Auto Spring Company, of Cleveland, Ohio, has taken out a permit for a factory.

The West Lake Machine Company, Toledo, Ohio, has doubled its capital and will make improvements.

The McComber-Whyte Company, of Chicago, Ill., manufacturing wire rope, will locate at Kenosha, Wis.

The Delaware & Lackawanna Railroad has purchased site at Binghamton, N. Y., for yards and repair shops.

The Republic Metalware Company, Buffalo, N. Y., will erect a seven-story addition to its plant on Republic street.

H. H. & E. M. Colehower are having a garage erected at Seventeenth and Diamond streets, Philadelphia, Penn.

The New York Central Railroad has inquiries in the market calling for about $50,000 worth of machinery.

The Pennsylvania Railroad is equipping roundhouse, machine and car-repair shops at yards in Northumberland, Penn.

The Cadillac Motor Car Company, Detroit, Mich., is to enlarge its foundry, also increase several of the machine departments.

American Drying Machinery Company, Cleveland, Ohio, has been incorporated by Wm. Miller, etc., with $50,000 capital.

The Baldwin Locomotive Works has purchased a 32-acre tract of land at Eddystone, Penn., on which it will erect additional shops.

The Farman Aëroplane Company, of Detroit, Mich., will build a factory for the manufacture of aëroplanes. A site is now being selected.

The Keiner Williams Stamping Company, Greenpoint, N. Y., will erect a new factory at Pine street and Jamaica avenue, Richmond Hill.

J. W. Powellson, of Rochester, N. Y., is organizing a company to establish a factory in Bath, N. Y., to make transmissions for automobiles.

The American Foundry and Machine Company, Hamilton, Ohio, is erecting an addition to its foundry and will also erect a three-story pattern shop.

The Imperial Manufacturing Company, Warren, Penn., will erect a branch plant at Welland, Ont., for the manufacture of saddlery, hardware, etc.

The Cleveland Axle Manufacturing Company plans to erect a large factory at Canton, O. A contract for the erection of the building has been awarded.

The Gisholt Machine Company, Madison, Wis., has awarded contracts for additions, including new shops and office building. About $155,000 will be expended.

Bertsch & Co., Cambridge City, Ind., are in the market for two second-hand electric traveling cranes of 40- to 70-foot spans and from 20 to 40 tons capacities.

The Sterling Stamping and Machine Company has secured a site in Elyria, O., and will erect a plant for the manufacture of automobile and motor-cycle parts.

The Bagley & Sewell Company, Watertown, N. Y., will erect a new factory to cost $40,000. The company builds paper and pulp machinery and conducts an iron foundry.

The Skinner & Skinner Company, 1716 Michigan avenue, Chicago, Ill., is in the market for one 3-inch hand screw machine and five or six automatic screw machines.

Hetherington & Berner, Indianapolis, Ind., will build an iron-foundry building at once at Kentucky avenue and White river. The new structure will cost about $20,000.

The Lozier Motor Company, of Detroit, Mich., is planning greatly enlarged manufacturing facilities to handle the line of heavy trucks it is going to put on the market.

The Willsea Works, Rochester, N. Y., has been incorporated to do a general foundry and machine business. Capital, $30,000. Incorporators, L. P., F. W. and E. J. Willsea.

H. V. Hotchkiss, superintendent of schools, Akron, Ohio, has issued a list of machine tools required for the manual training department for the Public South High School.

The Motor Repair Company, Ridgefield Park, N. J., has been organized by Fred A. Heyn, Joseph E. Colwell and Herman A. Berls. Will manufacture and repair automobiles.

Plans have been completed for a six-story factory for the International Harvester Company, of Chicago, in connection with the plant of the Deering division on Fullerton avenue.

The Trenjer Specialty Company, Trenton, N. J., has been incorporated to manufacture plumbers' specialties. Capital, $50,000. Incorporators, E. L. Fine, R. N. Burkert, W. J. Burkert.

The Buffalo (N. Y.) Aluminum and Bronze Company has been organized with $25,000 capital to do a general foundry business. Incorporators, G. W. Morris, J. G. Papell, E. G. Northrup.

The Benson Manufacturing Company, Owensville, Ind., has been incorporated with a capital of $25,000 by W. E., J. E. and B. F. Benson, to manufacture agricultural implements.

The Metalworkers Company, Chicago, Ill., has been organized to manufacture and deal in machinery, tools, apparatus, etc. Capital, $10,000. Incorporators, Albert Nathan, Chas. S. Stifft, etc.

Work will be commenced on new factory for the Ware Motor Vehicle Company at University and Pelham avenues, St. Paul, Minn., to manufacture a motor truck patented by J. L. Ware.

The Batavia Machine Company, Batavia, N. Y., has been incorporated to manufacture and deal in machinery, etc. Capital, $50,000. Incorporators, W. C. Couinlock, W. S. Couinlock, D. L. Herman.

The Cleveland Electric and Machine Company, Cleveland, O., has been formed to manufacture and sell all kinds of machines by S. J. Schwenger, Adolph S. Klein, August H. Bender, etc. Capital, $25,000.

The Requa Motor Company, New York, has been incorporated to manufacture motors, machinery, etc. Capital, $500,000. Incorporators, W. B. Walt, Jr., H. Sammet, New York; J. A. McCort, Brooklyn.

The Central Brass and Stamping Company, Peoria, Ill., has been incorporated to do a general manufacturing business. Capital, $30,000. Incorporators, Lewis Russell Nelson, Philip M. Nelson, Joseph Russell.

West End Plumbing and Heating Company, Lakewood, O., has been organized to manufacture and install all kinds of plumbing and supplies by Albert Ball, John W. Hunkin, Charles Brenner, etc. Capital, $50,000.

The Cleveland Steel Products Company, Cleveland, O., has been incorporated with $10,000 capital to manufacture all kinds of iron and steel products by C. L. Gates, Joseph H. Wennerman, L. A. Pejano, etc.

The Electric Weighing Company, New York, has been incorporated with $50,000 capital to manufacture electric-weighing apparatus. Incorporators, Edwin H. Messiter, 25 Broad street; Joseph A. Byrne, 2 Rector street, etc.

The Cleveland Electric and Machine Manufacturing Company, Cleveland, Ohio, has been incorporated for $25,000 by S. J. Schwenger, A. S. Klein, etc. Will do a machine-manufacturing business and electric devices.

The Cincinnati Tobacco Machinery Company, Cincinnati, O., has been incorporated to manufacture and sell all kinds of tobacco machinery. Capital, $50,000. Incorporators, Louis A. Hauck, Walter J. Freinlander, F. S. Baldwin, etc.

The Hofmann & Guenther Importing Company, Union, N. J., has been organized with $50,000 to manufacture embroidery machinery and appliances. Incorporators, A. Hofmann, C. Guenther, Union; M. W Gibbs, Weehawken, etc.

American Drying Machinery Company, Portsmouth, O., has been organized with $50,000 capital to manufacture and sell all kinds of drying and textile machinery. Incorporators, William Miller, A. H. Schupp, Hugh J. Tate, etc.

The Charles Hartman Company, Brooklyn, N. Y., has been incorporated to manufacture and deal in iron, steel, copper, etc. Capital $100,000. Incorporators, Charles Hartman, 647 Franklin avenue; Albert Hartman, 189 Windsor place, etc.

W. C. Durant and Louis Chevrolet are forming a partnership for the purpose of establishing a factory in Detroit, Mich., for the manufacture of the Durant-Chevrolet automobile. W. C. Durant was formerly with the General Motors Company.

The Navy Department, Bureau of Supplies and Accounts, Washington, D. C., will open bids June 27 as follows: One upright drill sliding head, one engine lathe, one gap lathe, one milling machine, one tool-grinding machine, one crank shaper. (Schedule 3658).

The Washington (D. C.) Steel and Ordnance Company has been incorporated with $1,800,900 capital. Plant will be located at Giesboro, D. C. Will manufacture iron, steel, coke, lumber. Incorporators, Eben B. Clarke, Jas. W. Kinnear, Wm. E. Best, of Pittsburg; Jas. E. Porter, Wilkinsburg, Penn.

SOUTHERN STATES

Smith & Smith are building a shop at Oxford, Md., for the manufacture of engines.

The Henry Vogt Machine Company, Louisville, Ky., is planning the erection of an addition to its boiler shop.

Work has been commenced on new factory building for the Johnson-Morse Can Company, Wheeling, W. Va. This concern recently took over the Wheeling Can Company and consolidated with the La Crosse (Wis.) Can Company.

WEST OF THE MISSISSIPPI

W. H. Murphy, Spokane, Wash., will build a commercial garage and repair shop.

Creighton & Colburn, Uplands, Cal., will build a commercial garage and repair plant.

George E. Barton, Dalton street, Spokane, Wash., will build a new commercial garage and repair shop.

The Speedwell Motor Car Company, Portland, Ore., will erect a three-story building at Fourteenth and Couch streets.

The Stearns Gas Engine Works, Los Angeles, Cal., has incorporated and is planning to increase present equipment.

The Hannibal (Mo.) Tool Company will move to St. Joseph, where new plant will be erected. The concern manufactures machinists' and automobile tools, etc.

The Hart Pan Company, Charles City, Iowa, has announced that two additional wings to its iron foundry will be erected.

The Manitou Copper Company, near Miami, Ariz., will build a new blacksmith shop and carpenter shop. Modern equipment will be installed.

M. G. Binford, Ocean Park, Cal., has taken out a permit to erect an automobile-repair shop at Los Angeles. Modern machinery will be installed.

The Arizona Iron Works, Phoenix, Ariz., has been reorganized, and will make additions and improvements in its plant. New equipment will be installed.

The Joseph Estate, San Francisco, Cal., is having plans prepared for a large commercial garage and repair plant. Ross & Burgren, architects, San Francisco.

The Sectional Threshing Cylinder Company, Spokane, Wash., is planning for the erection of a plant at Dishman for the manufacture of its threshing machines. D. C. Shaw is head of this company.

The Western Pacific Railroad has commenced the erection of its new shops near Sacramento, Cal. The plant will require fully a year to complete, and will be fully equipped for all classes of work.

The Globe Iron Works, Stockton, Cal., will remove its plant to Sacramento. Six new buildings will be erected, comprising machine shop, foundry, car shop, forge shop and pattern shop. The plant will be fully equipped.

The Lamb Manufacturing and Cotton Cleaner Corporation, Dallas, Tex., capitalized at $500,000 capital, will equip a plant for the manufacture of cotton machinery and sheet-metal work. W. A. Benton, president; Wm. R. Lamb, vice-president and general manager.

CANADA

The National Hardware Company, of Orillia, will double its plant.

The Grand Trunk Pacific Railway will build large new shops at Quebec City.

The Burton Saw Company, of Vancouver, B. C., will locate a big new plant at Moncton, N. B.

Albert Pontbriand, Sorel, Que., is purchasing machinery for a small shop to do general repairing.

The Hudson Bay Company is equipping a very large new garage and repair shop at Winnipeg.

The Grand Trunk Railway will equip a large new roundhouse and repair shops at Midland, Ont.

The Canada Pacific Steel Company will locate a $2,000,000 plant at Pitt Meadows, near Coquitlam, B. C.

Fifty thousand dollars' worth of machinery destroyed by fire in the New Brunswick Foundry plant at Fredericton, N. B., will be replaced at once.

Martin-Bennett Asbestos Mines, Limited, at Thetford Mines, Que., will equip a machine shop in connection with their plant which they are at present installing.

La Foundrie du Peuple, Limited, Joliette, Que., is installing machinery at present for general machine shop, foundry and woodworking purposes. About $15,000 will be spent.

FOREIGN

Jose Font, Casilla de Correo, Buenos Aires, Argentina, S. A., would like catalogs and quotations on metal-working machinery, including punching, cutting, bending, stamping and riveting machines for making metal pipes, tanks, iron plates.

GENERAL MANUFACTURING

NEW ENGLAND

Walter Baker Company, Milton, Mass., will install boilers.

Palmer, Mass., will make improvements in its sewer system.

Monson, Mass., contemplates installing a new sewer system.

Ansonia, Conn., will make improvements in its sewer system.

Keyes & Shallue, of Bridgeport, Conn., will build a new laundry.

New Britain, Conn., contemplates extending its water supply.

The city of Holyoke Mass., will install a boiler at the almshouse.

Keyes & Shallue, Bridgeport, Conn., will install boiler and engine.

The Bangor (Me.) Steam Laundry Company is building a new plant.

Arthur F. Pierce, of Huntington, Mass., will build new wood-working plant.

Critchley Machine Screw Company, Worcester, Mass., will build a new factory.

Pittsfield, Mass., has appropriated $56,500 for extending water and sewage system.

The Boston Duck Company will build an addition to the mill at Bondsville, Mass.

C. W. Dean & Co., Cochituate, Mass., are taking figures on power-house equipment.

The Corbin Shoe Company, Webster, Mass., is building a large addition to its factory.

Grant Yarn Company, Fitchburg, Mass., will build a three-story addition to its mill.

National Wadding Company, Marlboro, Mass., will install a new boiler in its factory.

The American Rubber Company, Cambridge, Mass., will build a new laboratory building.

The Richmond Mills Company, Augusta, Me., is to increase the equipment of its plant.

J. O. Cloggston & Co., of New Haven, Conn., will build an addition to its paper-box factory.

The Bay State Belting Company, Salem, Mass., will erect a new tannery at 50 Grove street.

The National Soldiers Home, Togus, Me., is taking figures for furnishing and installing boilers.

The Union Fish Company's plant, at Provincetown, Mass., was destroyed by fire. Loss, $15,000.

The Pacific Mills, cotton and worsted goods, of Lawrence, Mass., will build an addition to its mill.

The Oxford Paper Company, Rumford Falls, Me., has awarded contract for new mill buildings.

James L. Humphrey, Jr., will build an addition to his cold-storage plant at New Bedford, Mass.

J. E. Wesson Company, shoe manufacturers, are figuring plans for a new factory at Worcester, Mass.

The Lewiston Bleachery and Dye Company, of Lewiston, Me., will build a new factory, also additions.

Brown Brothers, of Gardner, Mass., manufacturers of toys, will build an addition to their factory.

The United States Government will install electric-pumping machinery at Fort Ethan Allen, Essex, Vt.

The Eastern Talc Company, of Rochester, Vt., will build a new power plant and an additon to its mill.

The Bay State Thread Company has taken out permit for an addition to the factory at Springfield, Mass.

The Mansfield (Mass.) Bleachery is to erect an addition to its plant. Work will be commenced immediately.

The Lewiston (Me.) Bleachery and Dye Works is to erect an addition near the site of its present factory.

L. H. Snyder & Co., Bristol, Conn., manufacturers of ceiling plates, will build an addition to their plant.

Pocasset Manufacturing Company will build an addition to its mill at Fall River, Mass. The concern makes sheetings, etc.

It is reported that the Niantic (Conn.) Menhaden Oil and Guano Company will rebuild plant recently destroyed by fire.

Grist mill, carpenter shop and planing mill, owned by Shippee & Co., lumber merchants, Apponaug, R. I., were destroyed by fire.

The Bristol Water Company, of Bristol, Conn., contemplates the expenditure of $50,000 in extending its water-storage system.

The New Haven Machine Screw Company, New Haven, Conn., has organized with $30,000 capital. John J. Reidy, president and business manager.

The Worcester Suburban Electric Company will build an addition to its power station at Uxbridge, Mass. Will be equipped with modern machinery.

The New Method Family Laundry Company, Winchester, Conn., has been incorporated with $25,000 capital by E. P. Jones, B. E. Cross, Winsted; Dwight S. Case, West Hartford, etc.

MIDDLE STATES

The Michigan Adjustable Hub Company will erect a new plant at Bay City, Mich.

Explosion destroyed plant of the Repauno Chemical Company at Gibbstown, N. J.

W. W. Mooney & Co., Columbus, Ind., will erect a tannery at Elizabethtown, Tenn.

Lincoln Trust Company, Jersey City, N. J., is to increase the capacity of its power plant.

Curtis Benjamin will move his button factory from Petersburg, Ind., to Mt. Carmel, Ill.

The plant of the Producers Torpedo Company, Macksburg, O., was destroyed by an explosion.

Equipment will be purchased for two municipal electrical-light plants of the city of Cleveland, Ohio.

The City Council, Pottstown Penn., will vote on the question of erecting a municipal electric-light plant.

The plant of the Root Dairy Supply Company at West Grove, Penn., will be moved to Dowingtown, Penn.

The Craiglaw Baking Company, Columbus, Ohio, has been incorporated for $50,000. Will erect a new bake shop.

The packing house of the Kingan Provision Company, Harrisburg, Penn., was destroyed by fire. Loss, $30,000.

Fire did $1,000,000 damage to the plant and lumber yards of the Standard Lumber Company, of Dubuque, Ia.

Plans have been posted for a four-story laboratory at Washington, D. C., for the National Bureau of Standards.

Pratt & Lambert, varnish manufacturers, Buffalo, N. Y., have awarded contract for the erection of a large addition.

The Plain Dealer Publishing Company, of Cleveland, Ohio, publishing the *Plain Dealer*, is having a new plant erected.

The Great Lakes Welding Company, Cincinnati, Ohio, has increased its capital and will make additions to its plant.

The Wood & Brooks Company, Buffalo, N. Y., manufacturing piano keys, will erect an $80,000 factory in Black Rock.

The Organic Chemical Manufacturing Company has let contract for the erection of its new plant at Fort Washington, Penn.

John Maddocks & Sons, Trenton, N. J., will increase the capacity of their power plant. Will install a new engine and boiler.

The Philadelphia Electric Company is having plans posted for an engine house at Thirty-first and Jefferson streets, Philadelphia, Penn.

The Art Engraving and Electrotype Company, Cleveland, Ohio, will soon locate in the new Prospect building. New equipment will be installed.

The Huntingburg Furniture Company, recently organized, will build a new furniture factory at Huntingburg, Ind. E. B. Fish is the president.

The Board of Education of Yonkers, N. Y., has let the contract for the erection of a power house for the Saunders Trades School. Cost, $11,338.

The Navy Department, Bureau of Supplies and Accounts, Washington, D. C., will open bids June 27 for 20 brazing torches as per Schedule 3688.

The Northern Ohio Traction and Light Company will build a steam turbine plant, reservoir and a hydro-electric plant, at Cuyahoga Falls, Ohio.

The Navy Department, Bureau of Supplies and Accounts, Washington, D. C., will open bids June 27, for 16 forced-draft blowers as per Schedule 3684.

Powers, Weightman, Rosengarten Chemical Company has let contract for an addition to its plant at Ridge avenue and Calumet streets, Philadelphia, Penn.

Two hundred and fifty thousand dollars will be spent by the city of Cleveland, Ohio, for a new hospital. Will require refrigeration and other equipment.

A permit has been issued for the erection of a boiler and engine house for the Commonwealth Brewing Company, 2730-32 Cambridge street, Philadelphia, Penn.

Fire totally destroyed the huge grain elevator and two large malt kilns of the Konrad Schreier Brewing Company, at Sheboygan, Wis. Loss, $400,000.

The yarn, cotton, wool and waste mill of Patrick Corr, at 2305 North Eighth street, Philadelphia, Penn., was badly damaged by fire. Estimated loss, $25,000.

Plans have been completed for a new factory building for the Lewis Hawthorne Company, on Chestnut street, New Haven, Conn. The concern makes building material.

The Rushville Furniture Company, Rushville, Ind., has been incorporated with a capital of $31,000 by W. E. Havens, A. L. Riggs, A. L. Stewart, etc., to manufacture furniture.

The Dayton (Ohio) Power and Light Company, which has recently been incorporated for $2,500,000, has raised its capital to $20,000,000. Its capacity will be greatly increased.

The Hires-Turner Glass Company, of Philadelphia, Penn., has purchased a large tract of land at Hague and Welcher streets, Rochester, N. Y., on which it will erect a branch factory.

The Isthmian Canal Commission, Washington, D. C., will receive bids up to 10:30 a.m., July 18, proposals to furnish steel rails for year ending June 30, 1912, as per Circular No. 635.

The Superior Storage Battery Company, Brooklyn, N. Y., has been organized to manufacture storage batteries. Capital, $25,000. Incorporators, R. Drambourg, H. Bonawitz, J. E. Reid.

Laird, Shober & Co., shoe manufacturers, Nineteenth and Buttonwood streets, Philadelphia, Penn., have purchased a site on which they will build an eight-story addition to their plant.

The Valley Yarn and Woolen Mills Company, Oil City, Penn., has purchased a site at Elm station, on the West Side belt line, near Pittsburg, Penn., on which it will erect a large plant.

The Wear-U-Well Shoe Company, Indianapolis, Ind., has been incorporated with a capital of $5000, by C. J. Barker, B. C. Hommon and W. N. Woodbury, to do a manufacturing business.

The Lyrachord Company, Yonkers, N. Y., has been organized with $150,000 capital to manufacture player pianos, etc., by J. T. Gibson, of Yonkers; O. P. Goldsmith, L. E. Sisson, New York.

Telling Brothers Company, Cleveland, Ohio, will spend $140,000 on a large retail and wholesale milk and ice-cream plant. Will also establish plants at Akron and Youngstown, Ohio, and Erie, Penn.

Frederick Safety Rail Company, Cleveland, O., has been incorporated with $10,000 capital, to manufacture patented safety rails, by C. H. Knight, R. E. Johnson, Edward Cecil, Barbara Frederick, etc.

Ottawa Tile Compnay, Ottawa, O., has been organized to manufacture tile, brick and other clay products. Incorporators are A. H. Wehringer, F. J. Wehringer, J. C. Wehringer, etc. Capital, $20,000.

A $60,000 fire wiped out the principal industries of the village of Big Springs, O., near Bellefontaine, O. A sawmill, planing mill, stone-crushing plant, etc., all owned by William Garwood & Son, were burned.

The Campbell Hosiery Manufacturing Company, of Philadelphia, Penn., has incorporated to manufacture hosiery and other articles from silk, woolen, cotton, or yarns. Incorporators are W. Campbell, M. Campbell and R. Campbell.

Proposals will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until 11 a.m., July 8, for auxiliary power-plant equipment at the Mare Island, Cal., navy yard. Plans and specifications can be had of R. C. Holyday, chief of bureau.

The Stephenson Company, of South Bend, Ind., manufacturer of woolen underwear, has secured site in Goshen, Ind., for new mills. A large brick building, formerly the property of the Goshen Rubber Company, is being remodeled and will also be used by the Stephenson Company.

The Navy Department, Bureau of Supplies and Accounts, Washington, D. C., will open bids June 27, for chain blocks, differential blocks, hand and pipe taps, pipe wrenches and spare parts (schedule 3691), machine bolts, galvanized bar and plate steel (schedule 3686), steel forgings (schedule 3682).

The Indianapolis-Chicago Meridian Railway Company, Indianapolis, Ind., has been incorporated with a capital of $100,000, to construct an electric railroad from Indianapolis to Chicago. The principal office of the new electric railway will be at Indianapolis. Directors, John C. Billheimer, John A. Shafer, M. J. Moreland, Hoover Holton and M. B. Keller.

SOUTHERN STATES

The Ogburn Buggy Company, Dublin, Ga., is preparing to build a plant recently burned.

The Carr Knitting Mills, Suffolk, Va., recently incorporated with $50,000 capital, will erect a mill.

The National Lead Company, St. Louis, Mo., will erect a five-story oxide mill at 5560 to 5570 Manchester avenue.

Bentley & Olmsted, shoe manufacturers, Des Moines, Ia., will build a new $100,000 factory at East First street and Court avenue.

The Mengel Box Company, of Louisville, Ky., has commenced the erection of a $100,000 branch plant in Fairview, Winston-Salem, N. C.

J. S. Silverstein, of Asheville, N. C., representing tanning interests, will build a tannic-acid plant and a pulp mill on property recently purchased.

WEST OF THE MISSISSIPPI

The city of Linnton, Ore., is planning to install a sewer system.

The Pacific Tank and Silo Company, Seattle, Wash., will erect a new plant at Centralia, Wash.

The Rialto (Cal.) Publishing Company is planning for the erection of a new publishing plant.

J. C. Hayter, Dallas, Ore., contemplates the erection of a new printing and publishing plant.

The Carquinez Packing Company, Benicia, Cal., will add fish-canning equipment to its plant.

The Applegrowers Union, Hood River, Ore., will build a new packing house. C. H. Sproat, manager.

G. K. King, Red Bluff, Cal., plans for the erection of a power plant on Mill creek in this district.

The H. N. Richmond Paper Company, Seattle, Wash., is having plans prepared for a new plant.

The San Francisco (Cal.) Gas and Electric Company is having plans prepared for a new power plant.

Arthur S. Bent, Los Angeles, Cal., will build a plant at San Diego for the manufacture of a patented cement pipe.

The Coos Bay Brewing Company, Marshfield, Ore., is planning for the erection of a new bottling works at North Bend.

The Mason (Nev.) Light and Power Company is planning for the installation of a waterworks system to serve this city.

John Shetterly & Son, Willamina, Ore., will build a new sawmill at Lyons, Ore., a new planing mill will also be erected.

The plant of the Consumers' Malting and Brewing Company, Ely, Nev., was destroyed by fire. All machinery was demolished.

A. D. Cutler, Red Bluff, Cal., is planning for the installation of a large pumping plant on the Sacramento river near Jackstaff Bend.

The Capitol City Box Company, Sacramento, Cal., has taken out a permit to erect a new plant to replace that recently destroyed by fire.

Fire in the plant of the Arkansas Brick and Manufacturing Company's plant, at Little Rock, Ark., damaged the plant to the extent of $100,000.

The boat-building plant of Albert Larsen, East San Pedro (Los Angeles), Cal., has been completely demolished by an undermining of earth.

The Palmer Annex Oil Company, Los Angeles and Santa Maria, Cal., is planning for the erection of an asphalt refinery in its Cat Canyon fields.

The Klamath Falls (Ore.) Water Users' Association, is planning to erect a power plant on the Klamath river. Bonds for $75,000 will be issued.

The Pacific Fruit Express Company, Brawley, Cal., has commenced the erection of a new pre-cooling plant. The plant will be fully equipped for icing cars.

Power-plant equipment will be required in the new 12-story building planned by the City & County Medical Association, Portland, Ore. Dr. A. C. Smith is interested.

The Eastern Oregon Realty Company, Baker, Ore., recently organized, is contemplating the installation of an extensive irrigation system in this section.

F. C. Barnes & Co., Marshfield, Ore., has leased quarters and will establish a fish-canning plant. Machinery for a capacity of 750 cases daily will be installed.

The Forward Brothers, Manton, Cal., operating a sawmill, will build a plant for the manufacture of boxes, fruit trays, etc. The factory will be fully equipped.

The International Moving Picture Company, Long Beach, Cal., recently incorporated, will build a plant for film manufacture. E. M. Dennison is head of this company.

The Alaska Coast Fish Company, Portland, Ore., recently organiezd, will build a fish-canning plant at Hook Harbor, Alaska. T. T. Tubbs is manager of this company.

Power-plant equipment will be required in the new court house to be erected at Moscow, Idaho. Estimated cost $150,000. Stritesky & Rooney, architects, Spokane, Wash.

The Oregon & Western Colonization Company (W. P. Davidson), Baker City, Ore., is planning to install an electric pumping system on the Snake river, near Nyssa, Ore.

The power plant of the Kendall Brothers (Pittsburg, Penn.) at Roseburg, Ore., recently destroyed by fire will be rebuilt. Herbert Sutherland is Oregon representative.

Power-plant equipment will be required in the new hospital to be erected by Doctor Cunningham, Oakland, Cal. Plans are being prepared by Meyer & Reed, architects, Oakland.

The Columbia Falls (Mont.) Lumber Company has been incorporated by C. C. Miller and J. E. Lewis, with a capital of $75,000. The Company plans for the erection of a plant.

The Lummi Bay Packing Company, Beach, Lummi Island, Wash., is planning for the erection of a fish-canning plant. John E. Rice, Bellingham, Wash., is interested in this company.

The City Laboratory, Spokane, Wash., will install a gas-testing plant in the coming fall, when appropriation will be asked of the legislature. Commissioner Fassett is in charge of this work.

The Pacific Aëroplane Company has been incorporated at San Francisco, Cal., by F. H. Howard and E. C. Webb, with a capital of $50,000. The company will build a plant in this section.

City of Terrell, Tex., has awarded contract for the erection of a power house in which will be installed an electric-light plant and waterworks. H. Galbraith, chairman, water commission.

Power-plant equipment will be required in the new apartment hotel to be erected by W. F. Young, Los Angeles, Cal. Estimated cost, $200,000. R. B. Young & Sons, Los Angeles, architects.

The San Pedro Paper Box Company has been incorporated at Los Angeles, Cal., by F. W. Weisenburger and C. N. Cordary. The company plans for the establishment of a plant in this section.

The Kern County Water Company, Bakersfield, Cal., is having plans prepared for a new power plant. Estimated cost, $100,000. Engineer H. E. Stone, San Francisco, Cal., is in charge of this work.

In connection with its proposed waterworks system, bonds for which will be voted in the near future, the city of Ellensburg, Wash., will install a pumping plant of 4,000,000 gallons daily capacity.

The city of St. Helena, Cal., has voted bonds for the erection of a union high school. A department will be established for manual training and shop work. Drafting rooms and laboratories will be installed.

John Cudahy, Chicago, Ill., has purchased property in the Imperial Valley, Cal., and will build a series of cotton-ginning plants. A factory for the manufacture of cloth products is also contemplated at Los Angeles.

The United Power, Irrigation and Development Company has been incorporaed at Seattle, Wash., by J. E. Wright and J. P. Smith, with a capital of $500,000. The company plans for extensive operations in this section.

The California & Oregon Grain and Elevator Company, a subsidiary of the Globe Grain and Milling Company, Los Angeles, Cal., has acquired property at Wilmington, near Los Angeles, and will build a large grain elevator plant.

The Washington Hospital for the Insane, Medical Lake, Wash., will build an addition to its power plant and increase the present capacity. A new blacksmith shop is in course of construction and will be fully equipped. J. M. Semple is superintendent.

CANADA

Calgary will build a new sewage system.

Cranbrook, B. C., will install a new sewer system.

A large new power house will be built at Orillia, Ont.

Wilmer, B. C., will equip a new waterworks pumping plant.

A large new power station will be built at Minnedosa, Man.

Carmangay, Alberta, will equip a new electric-light plant.

Galt, Ont., will greatly increase its hydro-electric machinery.

Victoria, B. C., will spend $500,000 on a new sewage system.

Southampton, Ont., will make additions to its water-pumping plant.

Carmangay, Alebrta, will install a complete new waterworks system.

Wilkie, Sask., will install a complete new waterworks pumping plant.

Strathroy (Ont.) Furniture Company is making further large extensions.

The Perth Carpet Mills Company will equip a large new factory at Perth, Ont.

Cardston, Alberta, will install a complete new waterworks pumping system.

Middleton, N. S., will spend $25,000 for additional electric-lighting machinery.

The National Paper Company, of Montreal, will locate a large new factory there.

Biggar, Sask., is calling for tenders for a complete waterworks pumping outfit.

The Free Press Publishing Company, of Winnipeg, will build a large new plant.

The Prince Rupert Hydro Electric Company will equip a new $5,000,000 system.

The British Columbia Sugar Refining Company will equip a new $80,000 filter house.

The British Columbia Sawmill Company will locate a $500,000 mill at Baynes, B. C.

The Elora Furniture Company will build a big extension to its factory at Elora, Ont.

Fire destroyed the plant of the Mines Power Company, at South Lorrain, Cobalt, Ont.

The Canadian Metal Seal Company will locate a large plant in Montreal. J. W. Blair is interested.

Messrs. Stewart and Rogers, of Victoria, B. C., will build a new electric line at Nanaimo, B. C.

A pork and beef packing plant is to be erected at Chatham, Ont., by O'Keefe & Drew, to cost $80,000.

The Alberta Glass Company will locate a large new factory at Redcliffe, Alberta. A. E. Cross, Calgary, is interested.

The Canadian Electric Welding Company will locate a large new plant at Montreal. G. V. Cousins is interested.

The Acme Construction Company, of Toronto, will build a new electric railway from Guelph, Ont., to London.

Fire did $50,000 damage at Lake Superior Corporation plant, Sault Ste. Marie, Ont., electric station being destroyed.

The Sunrise Telephone Company, of Grand Coulee, Sask., will build several new lines and will need much new equipment.

The Otis Quarries Company, of Montreal, will buy a large quantity of machinery to

develop its property. K. R. Otis, Montreal, president.

Fire destroyed $150,000 worth of machinery in the factory of the Dominion Corset Company at Quebec City. Will be rebuilt and enlarged immediately.

FOREIGN

V. Luisi & Co., Pietrasanta, Italy, would like to receive catalogs of pneumatic hammers, air compressors, stone-working machines for a marble-working enterprise.

MINING

The Springfield mine, Sulphur, Nev., will build a new milling plant.

The Hoat Gold Company, Gold Hill, Ariz., will build a new milling plant.

The Bailey mine, Golden Arrow, near Goldfield, Nev., contemplates the erection of a new mill.

The Neglected mine, Hermosa, Colo., is planning for the erection of a new mill and cyanide plant.

The Oakman mine, Washington district, near Nevada City, Cal., is planning for the erection of a stamp mill.

The Cornucopia Mines Company, Cornucopia, Ore., is planning for the installation of a new mill and cyanide plant.

The Mammoth mine, Goldfield, near Mesa, Ariz., contemplates the erection of a new mill. About $50,000 will be expended.

The Osgood mine, Yreka, Cal., contemplates the erection of a milling plant. F. H. Osgood, Seattle, Wash., is head of this company.

The Natividad mine, Sierra Juarez district, near Oaxaca, Mex., plans to increase the capacity of its cyanide plant in the near future.

The Hydro Electric Mining Company, operating at Placerville, Cal., is planning to install new machinery at its French Hill mine, for the extraction of platinum.

The California Gold Mining Company, operating at Keyesville, Kern county, Cal., contemplates increasing the capacity of its stamp mill. A. G. Keating is superintendent.

The Arizona-Southwestern Copper Company, operating at Yucca, Ariz., is planning for the erection of a 100-ton concentrating plant. Headquarters of company, Pueblo, Colo.

J. V. Nauhaus, Houston, Tex., has acquired the Copperosity mine, Casa Grande district, Ariz. The new owner will purchase and install a full equipment of machinery for operation.

BUSINESS ITEM

Edgar Allen & Co., Limited, proprietors of the Imperial Steel Works, Sheffield, Eng., with their chief American office in Chicago, have opened an eastern office at 71 Kilby street, Boston, Mass., with Harry B. Eaton, sales manager, in charge.

FORTHCOMING MEETINGS

American Railway Master Mechanics Association; annual convention, Atlantic City, June 14-16, 1911. J. W. Taylor, secretary, Old Colony building, Chicago, Ill.

Society of Automobile Engineers, midsummer meeting, Dayton, Ohio, June 15, 16 and 17, 1911. C. F. Clarkson, secretary, 1451 Broadway, New York city.

Master Car Builders' Association; annual convention, Atlantic City, June 19-21, 1911. J. W. Taylor, secretary, Old Colony building, Chicago, Ill.

National Gas and Gasolene Engine Trades Association, summer meeting, Detroit, Mich., Hotel Ponchartrain, June 20-23, 1911.

Society for the Promotion of Engineering Education, annual convention, June 27-29, Pittsburg, Penn. H. H. Norris, secretary, Cornell University, Ithaca, N. Y.

American Society for Testing Materials, annual meeting, June 27-30, Atlantic City, N. J. Edgar Warburg, secretary, University of Pennsylvania, Philadelphia, Penn.

National Society for the Promotion of Industrial Education; fifth annual meeting, Cincinnati, Ohio, November 2-4, 1911. R. T. Davis, secretary, 18 West Forty-fourth street, New York city.

American Society of Engineer Draftsmen, regular meeting third Thursday of each month H. F. Sloan, secretary, 116 Nassau street, New York city.

The Institute of Operating Engineers. Regular meeting second Thursday of each month, Engineering Societies building, New York City. M. W. Rice, secretary, 29 West Thirty-ninth street, New York City.

American Society of Mechanical Engineers; monthly meeting second Tuesday. Calvin W. Rice, secretary, 29 West Thirty-ninth street, New York City.

Boston Branch National Metal Trades Association. Monthly meeting on first Wednesday of each month, Young's hotel. D. F. S. Clark, secretary, 141 Milk street, Boston, Mass.

Providence Association of Mechanical Engineers. Monthly meeting fourth Tuesday each month. E. C. Bliss, president, 91 Sabine street, Providence, R. I.

New England Foundrymen's Association; regular meeting second Wednesday of each month, Exchange Club, Boston, Mass. Fred F. Stockwell, 205 Broadway, Cambridgeport, Mass.

Engineers' Society of Western Pennsylvania; monthly meeting third Tuesday. Elmer K. Hiles, secretary, Fulton building, Pittsburg, Penn.

Superintendents' and Foremen's Club of Cleveland; monthly meeting third Saturday. Philip Frankel, secretary, 310 New England building, Cleveland, O.

Western Society of Engineers, Chicago, Ill. Regular meeting first Wednesday evening of each month, excepting July and August. Secretary, J. H. Warder, 1735 Monadnock block, Chicago, Ill.

Philadelphia Foundrymen's Association; meetings first Wednesday of each month, Manufacturers Club, Philadelphia, Penn. Howard Evans, secretary, Pier 45 North, Philadelphia, Penn.

WANTS

Rate 25 cents per line for each insertion. About six words make a line. No advertisements abbreviated. Copy should be sent to reach us not later than Friday noon for ensuing week's issue. Answers addressed to our care, 505 Pearl Street, New York, will be forwarded. Applicants may specify names to which their replies are not to be forwarded, but replies will not be returned. If not forwarded, they will be destroyed without notice. No information given by us regarding any advertiser using box number. Original letters of recommendations or other papers of value should not be inclosed to unknown correspondents. Only bona-fide advertisements inserted under this heading. No advertising accepted from any agency, association or individual charging a fee for "registration," or a commission on wages of successful applicants for situations.

MISCELLANEOUS WANTS

Caliper catalog free. E.G.Smith, Columbia, Pa.

Special machinery developed and manufactured. Tompkins Bros. Co., Troy, N. Y.

Lyman's gear chart, 50 cents. Address E. Lyman, 431 Wilder Street, Lowell, Mass.

We buy or pay royalty for good patented machine or tool. Box 282, AMER. MACHINIST.

Wanted—Work for screw machines and gear cutter. Box 775, AMERICAN MACHINIST.

Light, fine machinery to order; models and electrical work specialty. E. O. Chase, Newark, N. J.

Automatic and light machinery, tools, dies, jigs and fixtures designed. B. Nash, 257 Martense St., Brooklyn.

Wanted—What have you to offer for machinery we could build to increase our business. Box AX, AMERICAN MACHINIST.

Light and medium weight machinery and duplicate parts built to order; tools, jigs, etc. MacCordy Mfg. Co., Amsterdam, N. Y.

Punches and dies, jigs and fixtures, light and medium weight machinery, etc., built to order. Taylor-Shantz Co., Rochester, N. Y.

Wanted—Machine and press work; tools, dies, jigs and machines built to order. The G. M. Diehl Machine Works, Wabash, Ind.

Patents. C. L. Parker, Patent Attorney, ex-examiner Patent Office, 990 G St., Washington, D. C. Write for Inventor's Handbook.

We must have more capital to meet growing demand for small, high class machine, without competition, write for particulars. Box 962, AMERICAN MACHINIST.

We are in the market for two second hand electric traveling cranes of 40- to 70-foot spans and with capacities from 20 to 40 tons. Bertsch & Co., Cambridge City, Ind.

Competent mechanical engineer, N. Y. City, designs special and automatic machines and tools for all kinds of duplicate work; highest references. Box 852, AMER. MACH.

Light and medium weight machinery and small parts in quantities; also screw machine and punch press work, tools, jigs, dies and high grade machinery. The Elgin Tool Works, Elgin, Ill.

Large English firm of machine tool importers having showrooms and offices in Great Britain, France, Germany, Italy, India and Japan is wanting good agencies for machine tools of all kinds. Box 189, AMER. MACH.

Auto cases and tubes first quality guaranteed:—28x3 $10.30, tube $2.75; 30x3 $11.30, tube $2.85; 30x3½ $15.45, tube $3.75; 32x3½ $18.70, tube $4.25; 34x4 $27.45, tube $5.75. Send for list of all sizes. 1 ship, allow examination on receipt of 10 per cent. amount of order. The largest tire dealer in the central States. W. Vanderpool, Springfield, O.

Business Opportunity—A New England corporation, first-class reputation and credit, well established in a most favorable business location, taking up a newly developed line of machine manufacturing business, desires an active partner with capital to take charge of machine shop; good business and profits assured; a young man with executive and mechanical ability, technical education and some experience in machine shop practice is preferred. Address for personal interview, giving name and address; no agents or promoters to Box 955, AMERICAN MACHINIST.

We will shortly be ready to place contracts for a large number of machines, weighing about 1000 pounds and requiring a good grade of work, about like machine tools; we desire to correspond with parties having modern equipment, who are in position to handle this work to advantage and are able to turn out high grade work at a fair price; we prefer to place the business with parties who are prepared to take care of our requirements for a considerable time; the product will stand a fair shop profit and if we can get the right kind of work and get it continuously, we are willing to pay a fair price; if interested, please state size of paint, number of men which can be employed on our work, and foundry facilities. Box 973, AMER. MACH.

A large and well known firm in central New England, which has been engaged in the manufacture of special machinery for upwards of forty years, is desirous of taking on some outside lines, its own legitimate line of manufacture being suffering from a depression in business, and in order to keep as many of its employees busy, and its organization as intact as possible during the dull period, we wish to make connections for taking on outside lines of machine work; our plant is a very complete and modern one; our machine tool equipment represents an investment of about $125,000; we have a full line of gear cutters, automatic screw machines, and Jones & Lamson turret lathes, etc.; our capital is ample, and we guarantee to handle in a satisfactory manner any work that may be intrusted to us. Write us your requirements. Address Box 72, Worcester, Mass.

HELP WANTED

Classification indicates present address of advertiser, nothing else.

CANADA

Wanted—A good wire worker, one capable of taking charge of a factory; must be thoroughly experienced and have good references. Address Box 975, AMERICAN MACHINIST.

CONNECTICUT

Wanted—First class toolmaker. Address B. L. Co., Norwich, Conn.

INDIANA

Wanted—Foreman for tool room; experienced man on punch, die and forming tools.

Apply by letter, giving detail of account of past experience. Box 926, AMER. MACHINIST.

MASSACHUSETTS

Speed boss wanted, a first-class, thoroughly practical man that has had experience as foreman or speed boss in an engine or pump plant; this man is wanted to go right on the machines and show the operatives, and is not wanted as an office statistician. Write very fully to Box 957, AMERICAN MACHINIST.

Cost accountant wanted; we wish to add to our permanent staff another competent accountant who is prepared by sound training and successful experience to take responsible charge of the organization of factory accounting systems, scientific planning of factory work, and improvement in methods looking toward increased productive efficiency; we prefer a technical graduate, and would be specially interested to hear from a man who has had marked success in constructive accounting for industrial plants or other enterprises. We are prepared to make the position attractive in respect to present salary and opportunity for the future; applications should be as complete as possible, stating age, nationality, present salary, whether married or single, and giving specific details of education and experience. Clinton H. Scovell & Company, Certified Public Accountants and Industrial Engineers, 110 State St., Boston, Mass.

NEW JERSEY

Wanted—Lathe miller and Jones & Lamson machine hands; also men used to filing on small work; steady work for competent men. Box 924, AMERICAN MACHINIST.

Foreman for department employing about thirty-five men on Monitor screw machine work; must be familiar with hand and automatic machine; an uptodate, energetic man required. Box 965, AMER. MACHINIST.

Assistant foreman wanted for machine shop building gasolene engines from 4 to 500 horsepower; must be familiar with uptodate methods and machines; must be energetic and capable of placing work so as to get the best possible results; apply by letter only, giving experience, reference and salary expected. Standard Motor Construction Co., 172 Whiton St., Jersey City, N. J.

NEW YORK

First class tool designers wanted for a large electrical manufacturing concern, near New York City. Box 967, AMER. MACHINIST.

Wanted—First class machinists, familiar with marine work, tool hands and outside men only; good wages. Box 942, AM. MACH.

Wanted—A first class belt salesman to sell belting for a large manufacturer. Address full particulars to "Belting," Box 946, AM. M.

Wanted—Active salesman for ball-bearing concern; good opportunity with growing business; state experience, age, and salary expected. Box 930, AMERICAN MACHINIST.

Punch press department of a large manufactory needs an experienced gang boss; state age, experience and wages expected. Address by letter only to Press, Alien Adv. Agency, 45 West 34th St., New York City.

Experience in designing tools for building dental engine hand pieces or similar appliances, and superintending their manufacture, will count heavily in your application for desirable position with "M." AMER. MACH.

Wanted—Machinists wanted, lathe hands, screw machine hands, etc.; steady position, desirable surroundings, good wages, no labor trouble. Apply by letter, giving account of past experience. Maxwell-Briscoe Motor Co., Employment Bureau, Tarrytown, N. Y.

Grinder hands wanted; those with experience on automobile crank shafts only and capable of running Norton grinders; steady position; apply by letter giving detailed account of past experience, names of previous employers and wages expected. Maxwell-Briscoe Motor Company, Employment Bureau, Tarrytown, N. Y.

OHIO

Young man experienced with heavy construction machinery to act as field correspondent for construction journal; ability to get good stuff, not literary style, the criterion. Box 959, AMERICAN MACHINIST.

Wanted—First class machinists, toolmakers, die sinkers, lathe, planer, drill press, screw machine, boring and milling machine operators, wood and metal patternmakers, brass polishers, buffers, finishers, millwrights, hammermen and blacksmiths, who wish to increase their opportunities, to register with the free Employment Department of the National Metal Trades Association, New England Building, Cleveland, Ohio.

PENNSYLVANIA

The Monotype School is maintained to train young men to meet the constant demand for operators of our type casting and composing machine; these operators do so well that we receive more applications for places than can be filled; these qualifications carry most weight: Common sense, automatic machinery experience, printing office experience, type foundry experience. Full particulars will be furnished to inquirers who furnish the same information about themselves, and mention this paper. Lanston Monotype Machine Co., Philadelphia.

RHODE ISLAND

Wanted—Fifty tool designers; experienced competent men in the design of jigs, fixtures, punches and dies and other special tools used in the manufacture of high grade machine parts on an interchangeable basis; apply by letter stating age, experience and salary required, as well as the date when you would be able to start if application was accepted. The Taft-Peirce Manufacturing Company, Woonsocket, R. I.

SITUATIONS WANTED

Classification indicates present address of advertiser, nothing else.

CANADA

Mechanical superintendent, broad experience in factory efficiency, executive and a organizer, engaged, would correspond, location immaterial. Box 902, AMER. MACH.

CONNECTICUT

Uptodate superintendent desires change; best references from leading companies and reason for changing; correspondence strictly confidential. Box 971, AMERICAN MACHINIST.

Mechanical engineer open for engagement about July 1; 15 years' experience, expert mechanic, thoroughly practical and uptodate; would consider position as chief draftsman, general foreman, master mechanic or superintendent. Box 964, AMERICAN MACHINIST.

MASSACHUSETTS

Mechanical engineer with over 13 years' practical and successful experience in executive position, desires change; technical graduate; thorough shop man. Box 948, AM. MA.

Superintendent or assistant superintendent; 20 years' practical experience on general machine and tool work; uptodate in organization and cost systems; best of references. Box 954, AMERICAN MACHINIST.

MICHIGAN

Executive, 28 years old, married, with ten years' experience in production, stores, time and cost; premium system as an adjunct to time and cost. Box 963, AMER. MACHINIST.

NEW JERSEY

Mechanical engineer, graduate, with ten years' designing and shop experience on water turbines and general machinery, with best references, desires change. Box 947, AM. MA.

Assistant to foreman, familiar with machine shop, foundry, patternmaking work and structural shop work, also shop drafting; open for engagement July 1; age 42; references. Box 931, AMER. MACH.

Superintendent or works manager, now engaged, desires change; will take charge of plant employing from 200 to 600 hands; uptodate, an organizer, a high class executive, and a thorough mechanic; high grade work preferred. Address "E," AMER. MACHINIST.

NEW YORK

Responsible position by thorough mechanic, modern shop methods, best references. Box 945, AMERICAN MACHINIST.

Master mechanic and chief planner desires change; capable man, large job; splendid record. W. J. H., AMER. MACH.

Correspondence student, age 22, desires position in drafting room; five years' machinist experience. Box 958, AMERICAN MACHINIST.

Mechanical engineer, technical graduate, eight years' experience, desires a position in or near New York City. Box 949, AM. MACH.

Chief draftsman, mechanical engineer (38), 17 years designing pumping machinery, steam engines, condensers, desires change. Box 968, AMERICAN MACHINIST.

Uptodate foreman desires change; experience on tools, jigs and general manufacture; good executive; first class references. Box 953, AMERICAN MACHINIST.

Designer, 29, ten years' experience special machinery, tools, etc., for interchangeable parts, also experimental work, desires responsible position. Box 944, AMER. MACH.

Expert mechanic, having 18 years' experience as salesman and trouble man, will be open for position July 1; highest class references as to ability and integrity. Box 961, AMERICAN MACHINIST.

Valve, tool, dies, fixtures and special machine designer desires change; age 28, capable of handling men; technical graduate; 7½ years' practical, one year shop. Box 960, AMERICAN MACHINIST.

Manufacturing engineer; thoroughly grounded in different phases of light and medium manufacturing on large scale; successful record, with present employers ten years. Box 900, AMERICAN MACHINIST.

Foreman toolmaker, wide experience tools, dies, jigs, fixtures, experimental work, special machinery, etc., for fine accurate work; photographic shutter, instrument, telephone, etc., well up on modern methods, good executive, desires position July 1. Box 972, AM. MACH.

Practical man, 28, having had ten years' experience as tool and die maker, machinist and draftsman, three years' experience on road selling machine tools, uptodate both business and practical, wishes change, responsible position. Box 974, AMER. MACHINIST.

Wanted—Position with responsible company, having special machinery to design and develop, by thorough mechanic who has successfully handled this class of work for number of years and can give satisfactory references; New York or New Jersey preferred. Box 970, AMERICAN MACHINIST.

OHIO

Foreman screw department, 35 years of age, now employed, wants to change; experienced automatic operator, estimator and tool designer for same; best of reference. Box 950, AMERICAN MACHINIST.

Superintendent, at present employed, desires change; 20 years' factory experience; first class mechanic, experienced in all branches, accustomed to very accurate work as well as medium grade; references. Box 969, AMERICAN MACHINIST.

A live energetic man, 36 years of age, 13 years executive experience, desires position as works manager or superintendent; experienced in modern shop management, piece work, premium and standard time systems; A-1 references; salary must be liberal. Box 951, AMERICAN MACHINIST.

Wanted—Position as manager or general superintendent; thoroughly practical and experienced in the management of manufacturing plants, consisting of main office, machine shop, foundry, blacksmith shop, boiler shop, wood shop and kindred departments; will take charge on salary or commission or both, and with highest degree of productive efficiency and lowest cost of production, guarantee freedom from labor troubles of every description. Box 966, AMERICAN MACHINIST.

A superintendent with 20 years' experience and a factory manager with 15 years' experience, both 35 years old and connected with same company and more than making good, desire a wider field and will make a profitable change; will guarantee to organize and systematize any manufacturing establishment, obtain maximum output at minimum cost; correspondence is invited or a visit to the plant where they are at present employed. Box 925, AMERICAN MACHINIST.

PENNSYLVANIA

Capable, experienced superintendent of plant manufacturing machinery, solicits correspondence with parties desiring the services of such an executive. Box 934, AMER. MACHINIST.

FOR SALE

Patent on combined nail puller and band cutter for sale. Box 952, AMER. MACHINIST.

Acme nut tapper, 4 spindle, new, takes ¾ to 1 inch hexagon or square; cost $350, price $200. J. L. Lucas & Son, Bridgeport, Conn.

For Sale—One second hand Niles 26-inch by 21-foot engine lathe, complete with countershaft and attachments. A quick buyer gets a bargain. The Platt Iron Works Company, Dayton, Ohio.

For Sale—Two pieces (total length 825 feet), 16-inch new rubber and canvas composition conveyor belting, 5/16 inch thick. Write for particulars. Oliver Chilled Plow Works, South Bend, Ind.

For Sale—One 7¼-inch new model Cleveland automatic screw machine with three spindle speed attachment, tilting magazine and complete set of tools; new machine in perfect condition; has been used not more than 700 hours; not adapted to our work. Box 956, AMERICAN MACHINIST.

For Sale—One Hendey Norton 14-inch engine lathe with taper attachment, good as new; one Brown & Sharpe No. 2 surface grinder with magnetic chuck and generator, new; one small combination tool and disk grinder; I will sell the above at private sale or arrange to accept executive position as superintendent, tool designer or similar position with sale of tools on easy terms. Box 939, AMERICAN MACHINIST.

Talks With Our Readers

By The Sales Manager

Why do we devote so much space to talking about honesty in advertising?

We realize that one of the greatest drawbacks to present-day advertising is the habit that readers have of discounting advertising statements, which works against them as well as the advertiser. We cannot get the greatest good out of anything unless we have confidence in it.

Concerns are appreciating more and more that the truth is better—not alone from moral reasons but that it pays, in dollars and cents.

And even if an advertiser in the AMERICAN MACHINIST wants to put misleading statements in the advertisements that appear in the paper, he can't, if we know it.

But, as a further safeguard, you will be interested to know that in New York, and other States, there's a law regarding this.

The New York statute reads:

421: UNTRUE AND MISLEADING ADVERTISEMENTS:

Any person, firm, corporation or association, or any employee thereof, who, in a newspaper, circular or other publication, published in this state, knowingly makes or disseminates any statement or assertion of fact concerning the quantity, quality, the value, the method of production or manufacture, or the reason for the production of his or their merchandise, or the manner or source of purchase of such merchandise, or in the possession of rewards, prizes or distinctions conferred on account of such merchandise, or the motive or purpose of such sale, intended to give the appearance of a plan advantageous to the purchaser, which is untrue or calculated to mislead, shall be guilty of a misdemeanor.

Any person, firm, corporation or association, or any employee thereof, who violates any provision of this section shall be liable to a fine of not less than $25, or more than $100, for each offense.

Until recently this law was a dead letter.

On April 24, Frank C. Gevin, of the Plymouth Raincoat Company, was found guilty under the statute by the Court of Special Sessions in New York City.

The defense did not put in any evidence in its own behalf, and rested its case entirely on the argument that the facts as presented do not constitute a crime within the meaning of the statute and were "nothing more than a harmless exaggeration common in business and begotten of enthusiastic salesmanship."

* * *

"The decision of the Court," says Assistant District Attorney Stryker, "gives a broad interpretation of the statute and vindicates the intent of the legislature as being exactly what one would infer from the statute, namely, to discourage untrue and misleading advertisements and protect competing merchants and the public."

* * *

Only reliable products can be continuously advertised.